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THE TEACHING OF HYGIENE AND SANITARY SCIENCE IN THE SECONDARY SCHOOLS[1]

AT the last meeting but one of the Schoolmasters' Club I presented a "Plea for the Teaching of Sanitary Science in our Public Schools," and in the college section of the State Teachers' Association a similar one, the special plea at this time being for the teaching of this science in our colleges and higher institutions of learning. The first of these papers has since been published in the January number of *Education*, and the second one may be found in the published proceedings of the state association. From the fact that a request has now come for a further consideration of this subject I am pleased to believe that in several important particulars we have reached settled conclusions. We are all coming to a just appreciation of what sanitation will do, that it will be the means of incalculable good to the citizens of our state, that the claims which sanitarians make of the good already being accomplished are true and well founded, that with the present conditions and workings of the health administration very many lives are saved each year, that this good work can largely be augmented by the intelligent coöperation of all the people, and that, therefore, we, as educators, are justified in giving this subject a place in our course of study. The past two years have witnessed a very great willingness on the part of the teachers of Michigan to enter heartily upon this work. The state board of health has

[1] Proceedings of the Michigan Schoolmasters' Club.

been taxed to the full extent of its appropriations in order to supply the literature asked for by those who are paying special attention to this subject in their schools. It would thus seem that the two systems of public health and public education are henceforth to be intimately associated, the one aiding the other, and that the knowledge of how to preserve the body in the full possession of all its powers and for the greatest number of years "shall be taught in every school to every pupil," to the end that the legitimate work of the schools, the training of the mental and moral faculties, may proceed with the most certain success.

It has been urged that for the study of hygiene, as it has been carried on in the past, there shall be substituted sanitary science, and that its practical application in the schools should have regard to those causes which produce severe sickness and untimely deaths rather than those sanitary or hygienic sins which merely produce temporary discomfort. And just here is found our first general answer to the question, What shall be taught? namely, teach those facts and principles which have for their end the far-reaching and beneficent result of preventing sickness and premature death. To use a concrete exampie as an illustration of the principle, do not spend the time allotted to this subject in teaching the errors of diet, eating too much or too rich food at late hours or between meals, if that is to take the place of teaching the method by which the spread of sickness and death from scarlet fever is prevented. This work is important, and yet it is true that comparatively few die from errors of diet, while many die from scarlet fever, diphtheria, and other communicable diseases. To be sure, there are factors which concern health only a little less potently than those agencies which directly produce disease and death, and some consideration of these should find a place in every course in sanitary science. Such are the subjects of water supply and ventilation.

A second general answer to the first of the three inquiries, what to teach, is one applicable to all new subjects, and yet one not thoroughly appreciated by teachers. Every new subject has its technical terms, its peculiar language, its dialect, if you

please, and this is peculiarly true of sanitary science. This language must be learned, its technical terms mastered, defined, translated, and put into practical use. For example, suppose I read the statement in the daily paper that "In February last an outbreak of diphtheria occurred in Blank township which rapidly became epidemic, owing to the failure of certain physicians to correctly diagnose the first cases. Proper precautions are now being carried out, all exposed persons are promptly isolated, the premises placarded, and the rules regarding isolation of the patient and thorough disinfection of all articles which have become infected are rigidly enforced." In the brief statement occur several technical terms which are peculiar to this subject, such as "outbreak," "epidemic," "diagnose," "proper precautions," "placarded," "isolations," "disinfection," "infected." Pupils should be taught to use these words clearly aud intelligently. They should also be taught to "read between the lines" and to verify, by some work of their own, such statements as will admit of this treatment.

For example, suppose I read the statement that "In greater London 2082 deaths were registered during the week ending December 5, 1896, corresponding to an annual death rate of 17.6 per thousand of the population." Let the pupil ask and answer the questions: What is the population of greater London? What is the total annual mortality of that city? Notice that the object here is not to ascertain the population of greater London, but rather to scrutinize the statement that its meaning may be clearly apprehended and that a habit of thus testing such state ment shall be inculcated. Take another example : The reports of the supervising surgeon-general, United States marine-hospital service (who is he and what are his duties?), for the month of November 1896, show that in Minneapolis, with an estimated population of 192,833, there were 150 deaths; in Buffalo, with an estimated population of 350,000, the total deaths were 309, and in Cleveland, estimated population of 330,279, total deaths were 346. These statements of themselves convey little, if any, significant or intelligent information. Are these rates high or

low? How do they compare with each other? How do they compare with the state of Michigan? With the town in which I live? We have not done our duty by them when we have merely pronounced the words or read the sentences; they must be digested, assimilated, transformed, compared. Let the teacher and pupil, therefore, cultivate the habit of answering the numerous questions which are raised by such statements. Compare the three cities named as to healthfulness. Find statistics, if possible, of your own town and make comparisons with the above. What would have been the total annual mortality in your own town at the rate shown above for Buffalo? How many people died in the state of New York during the year 1896, if the death rate for the whole state was the same as that shown above for Buffalo? How many in Michigan at the same rate? etc.

It has been my purpose to give at this time a more specific and detailed answer to the question: What shall we teach? but this cannot be done until we have determined the proper answer to the How much and the How? From some standpoints it is to be regretted that we have no suitable text-book on this subject, and yet this very condition will make sure that much material, which in its way is the best in the world, will be utilized and thus enable it to serve the purpose for which it has been produced. Very little literature, I imagine, receives as much study and revision, pruning and correction, as much time spent in attaining to absolute scientific accuracy, as have the circulars issued from the office of the state board of health. They represent the work and experience of a great many years; they have stood the test of actual use in the practical affairs of sanitary science; they have been constantly revised and brought up to date. All of this material is placed at the disposal and for the use of the teachers of Michigan. From it and other sources can he gathered the subject-matter for a successful school course. The subject will, therefore, need to be taught orally, and this is the method contemplated in the law passed by the legislature of 1895. The following is a brief bibliography of these publications with which every school should be provided:

One of the late reports of the Michigan state board of health.

One of the late volumes of the vital statistics issued by the secretary of state.

The latest United States census reports, especially the volumes on vital statistics.

The compiled health law of Michigan.

Various reprints issued by the state board of health and referred to farther on in this paper by number.

Special circulars on each of the leading diseases, published by the state board.

Bulletins 130 and 140 of the Michigan Agricultural College experiment station.

The amount of the instruction given in different schools will vary according to the interest in the subject and the fullness of knowledge possessed by the teacher. Under the present conditions the time will necessarily be somewhat limited, and therefore this paper and the practical suggestions which follow are based on the thought of one exercise per week for twenty weeks. The course here outlined must be understood as a merely tentative one, subject to amendment and modification as experience shall suggest.

My own thought concerning the method of conducting the work is to make it, as far as possible, the result of research work conducted by the pupils themselves. Having access to the authorities cited above, they can be furnished with certain questions which, when the answers have been obtained, will form the basis of a further discussion by teacher and class. A good pedagogical principle, applicable here as elsewhere, will be to tell a pupil nothing which he can find out for himself. But the teacher must know the subject himself.

Lesson 1. The object of this lesson might be to set forth the necessity and the nature of the instruction in sanitary science and at the same time to show the far-reaching results growing out of such instruction. Every subject should have its complete justification for taking the time and attention of our schools,

and this new subject must demonstrate its worth and its right to be.

Consult dictionary and encyclopedia for definitions of sanitary science. It should be remembered, however, that definitions from books which are a decade old will need to be modified so as to contain the thought that the practical application of the principles of sanitary science produces a marked decrease of sickness and the saving of hundreds of human lives; that prevention is the watchword and not cure; that the means of prevention are well known and so simple that they can be understood and put into practice by the common people.

Now let the investigation proceed along the line of the following questions: What is the population of the state? Learn incidentally other interesting facts, such as number of native and foreign-born, number living in cities and in the country, number in the upper and lower peninsula, etc. What number die each year from all causes? What per cent. is this number of the entire population? Stated in another way, this mortality is about how many per thousand of the entire population? How does the statistician classify the causes of death? What per cent. of the total mortality is of most interest to the sanitarian because of the fact that it belongs to the preventable class? What, then, is the sanitary problem to be solved by the united coöperation of all the people of the state of Michigan? These and other facts may easily be obtained by consulting the vital statistics of Michigan. They are summarized in *Education*, January 1897, p. 272.

Lesson 2. This lesson may be of the same nature as the first, but directed more specifically to the statistics of the eight leading diseases which cause the greatest number of deaths in Michigan. Notice that those diseases which cause the most sickness do not necessarily cause most deaths. On this latter point consult reprints No. 425 or 209 of the state board of health. The principal basis of this lesson will be reprint No. 226, and especially the first half of the first page. The diagram[1] there given

[1] In Michigan the most dangerous communicable diseases, named in the order of

was made from figures gathered during the ten years 1884–93, and included in the aggregate for the ten years 54,879 deaths. The diagram may also be taken to represent the relative importance of the given diseases for any one year. Now suppose, which is approximately true, that one thousand people die in Michigan each year from typhoid fever. Notice that the line in the diagram representing the deaths from that disease is just one inch long. How many deaths from scarlet fever? From diphtheria? From consumption? What per cent. is this last number of the total mortality in the state? If one in every eight of deaths, the world over, is from consumption, "the great white plague," how many die each year in the United States? etc., etc. Close the hour with the thought that all this can be prevented when the people as a whole learn how to coöperate with this end in view.

Lesson 3. An elementary lesson in bacteriology.—One lesson should be devoted to giving elementary ideas concerning the relations which germs or bacteria bear to disease and death. Look up definitions of disease; notice the etymology of the word disease, *dis-ease*. Give the pupils some general idea as to how germs are handled, how they are grown, what is meant by pure cultures, how they are identified, how the relation of a specific micro-organism to a specific disease is established, etc. For this lesson, Professor Marshall's papers, Bulletins Nos. 139 and

their importance as causes of death, are consumption, pneumonia, influenza, diphtheria, typhoid fever, scarlet fever, measles, whooping-cough, and smallpox.

The relative importance of these diseases is shown by the diagram below. Consumption causes many more deaths than does any other disease.

DEATHS IN MICHIGAN, 10 YEARS, 1884–93.

Consumption

Pneumonia.

Diphtheria.

Typhoid fever.

Scarlet fever.

Measles.

Whooping-cough.

Smallpox.

140, issued by the Agricultural College experiment station, are very valuable.

Lesson 4. Health administration and health laws.— How are the sanitary forces organized by which the work of sanitary reform is to be carried on? The state board of health, its membership, how selected, term of office, salaries, executive officer and his duties; the threefold nature of their work, to collect information, to collate and study this information, to spread the knowledge thus obtained among the people; their relation to the state advisory rather than mandatory. Local boards of health, in townships and cities, organization, duties, responsibilities, relation to state board, must appoint a health officer. The health officer and his powers and responsibilities; physicians and their legal relation to communicable diseases. Lastly and most important of all, the people and their duties and responsibilities under the law. Reprints Nos. 297, 120, and 425 will be helpful for this lesson.

Lesson 5. Means of prevention.— This lesson will deal with the two means which are constantly in use, namely: Isolation and disinfection. Place emphasis on the fact that these means are worthless, or at least they count for very little, unless they are most thoroughly carried out. For example, to burn a little sulphur in the sick room is not disinfection; but the directions must be followed and at least three pounds of sulphur burned for each thousand cubic feet of air space. Isolation is not thoroughly practiced if the mother or the nurse, the cat or the dog, or anything is allowed to pass from the sick to the well or from the room in which the sick are to that part of the home occupied by the well. Study the special circulars on diphtheria and scarlet fever for specific directions concerning isolation and disinfection.

Lesson 6. Life saving.— From my standpoint of experience it will pay to spend at least one exercise hour in making the proof that the efforts which are being made do actually result in the warding off of much sickness and the prevention of many untimely deaths. Study the facts which can be gleaned from

Plate No. 547: "Isolation and Disinfection Prevent Scarlet Fever." The conclusions shown in this diagram are perfectly reliable, having been drawn from statistics gathered with the greatest care. The word "outbreak" as used on this diagram perhaps needs definition: For studying the influence of isolation and disinfection in restricting outbreaks of communicable diseases, an outbreak is considered as the existence of one or more cases of a particular communicable disease within any health officer's jurisdiction, whether city, village, or township. All cases of the disease occurring within the jurisdiction during the outbreak are considered as part of the outbreak, unless the contagium cannot be traced to cases within the jurisdiction, and can be clearly traced to cases outside of the jurisdiction, in which instance they are considered as constituting a separate outbreak. Heretofore, when a period of sixty days or over has elapsed since the last case (in a given jurisdiction) died or recovered, the outbreak has been considered ended. In order to study the subject systematically there must be a limit in time, as also in area.

With this diagram before the pupil, let him answer such questions as: How much time is involved in the facts represented? What is the total number of outbreaks? In how many outbreaks was it reported that isolation and disinfection were enforced? How many reports show that these means were neglected? In the former cases, how many persons sick, on the average, per outbreak? How many deaths? Total cases of sickness for the 361 outbreaks? What is shown by a comparison of the average number of cases of sickness when isolation and disinfection were enforced and when neglected? What would have been the total number of cases of sickness if in all the 1857 outbreaks these means had been (*a*) neglected and (*b*) enforced? What is the lesson learned from the comparison of the numbers? Make similar comparisons for the relative number of deaths. Compute the total annual doctor's bill for the state for the sickness from this one disease, supposing that the average period of sickness from scarlet fever is four weeks and the doc-

tor's daily calls at the rate of one dollar a visit. Compute the undertaker's bills and funeral expenses at the rate of $50 per death.

Close this lesson with the thought that four-fifths, perhaps, of all this can and ought to be prevented, and will be prevented when all have learned to practice the rules of sanitary science. It would do no harm to turn this lesson into one on social science and enforce the truth that one of the great factors, if not the greatest, which produces poverty and distress in this country is disease, with its loss of productive labor and its great debt which must be paid to the physician and the undertaker.

Lessons 7 to 13, inclusive, may be detailed studies of each of the leading communicable diseases. One disease should be studied at a time, the facts being gathered from the special circulars prepared in and sent out by he state board of health. These may be enlarged upon by researches in any authorities which may be accessible. When several have been studied, or during the course of these lessons, constant comparisons should be made of these diseases with each other, noting their likenesses and differences.

These lessons should cover the questions of the specific causes of the disease, part of the body affected, premonitory symptoms, period of incubation, mode of spread, and methods of prevention. In this way consumption, diphtheria, typhoid fever, measles, whooping cough, and smallpox should be carefully studied.

In connection with the study of typhoid fever the question of water supply may receive attention, especially the relation which the well sustains to the receptacles for infected excreta and the method by which the typhoid germs make their circuitous, but certain way, from the body of the sick to that of the well.

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THE GROWTH OF MIND AS A REAL AND THE INFLUENCE OF THE FORMAL ON THE REAL

II

CHAPTER IV

ASSIMILATION ON THE PLANE OF REASON

We have now reached the end of purely dynamic reflex-activity in the building up of the real of mind by the assimilation of experiences, although we have had occasionally, for the sake of clearness, to anticipate the next and supreme movement which has been exhibited in its general process (Vid. Institutes), but not in its relation to the real. The highest result of the natural dynamic is that relation of mind to object which we call attuition, and the resultant possession is a multitude of mutually assimilating and fused attuits—what I have called sensational general concepts. The world of experience is as yet to consciousness a crude, yet connected, mass of individuals and spurious generals. Things are fused, not woven. It is the work of reason to elaborate a true organic context.

On the attuitional plane, all presentates fall under the generic name of sensates, and so likewise do all representates. An attuit is a sensate, but it is a sensate of a complex total out there in its complex totality. Our next step in building up mind is, as I have frequently affirmed, activo-active or pure; in brief, a formal energy which deals with the assimilated masses and series delivered to us in sense-experience—assimilated, and, so far, crudely organized. The first moment in this formal activity is percipience, and so forth, as already expounded in previous chapters.

NOTE.—Assimilation (let me repeat) here in the subject is another name for relation there in the object. It is the mind-side of the system of natural relations in so far as these can be revealed to mere sense.

Objects as totalities and the relation of these to the universal and indefinite totality — external relations of time and space or real relations of likeness and unlikeness — are accepted in a rough and ready way, sufficient, however, for animal guidance. The associated aggregate *here* is a reflex of the related aggregate *there* — rude, crude, inaccurate, inadequate, and, from the standpoint of a higher mind-evolution, chaotic. The pure energy of the dialectic process (which is man-mind) advances actively, and with purpose, to differentiate, discriminate, generalize, and rationalize, in so far as it can do so, with a view to an end which is truth ; and conduct as determined by truth.

When I say that what is called assimilation of experiences to each other is merely the mind-side or reflection of an already existing objective relation I of course mean primary associations of one presentation with another, *e. g.*, a tree with a field or a tree with its own parts, or the sun and moon and stars with the sky and each other. The moment any presentate has become part of the real of mind it may recur as a re-presentate, and, as such, associate itself with a quite new experience from without. The re-presentate "lion" may arise in my consciousness coincidently with the presentation of a waterfall, and these are thenceforth associated in mind, either externally (space and time) or really, as negating all community of existence with each other.

Assimilation on the plane of reason is like that of attuition, the fitting in of new facts to a general concept, or a reasoned or a causal relation. If they do not fit in, they are left outside in isolation till they find a place in the unity to which they rightfully belong. The most advanced intellect is always engaged in this process of rational assimilation.

The formal movement, as essentially a will-movement, contains in it the principle of activity and of search, which, under the stimulus of end or purpose implicit in it, extends the range of receptivity immeasurably. It does not, however, itself form an addition to the mass of attuitional or recipient material beyond the consciousness of itself, as a fact and process, when man becomes reflective. Its function is to break up the existing aggregates of experience and, by discrimination and comparison, to raise them into a new and rational synthesis without thereby cancelling them. Its method is analytico-synthetic. It ever seeks, and must seek, purified and causally grounded notions of reality. Sense-reality thus becomes rational reality, not by having the rational imposed on it, but by having the rational in it made explicit. We are here evidently outside the mere dynamics of mind-growth, and are subjecting the total of our

dynamic or natural experience to the operation of a free reason-movement, which tosses about the real as given in sense and contains, in its own process, the process already existent in the universe of things, which (under the impulse of search for end) it seeks to make evident. With every step of true advance it comprehends more of actual reality of the individual and the whole.

Formal reason, as a process whose root is will, *first of all* reduces sensates, presentative and representative, and their associated and assimilated products to the unity of self-consciousness and affirms them. This affirmation emphasizes and accentuates the attuitional experience. The natural thus at once becomes the rational. The truth of the individual sensate is in the percept; the truth of the attuitional whole is in the concipient one or unity; the truth of the vague and floating "general" is in the general concept; the truth of vague relations, which are merely felt, is in the necessary connections of a syllogism, inductive and deductive; the truth of invariable sequence is in the causal relation. But all this adds nothing, I say, to the building up of mind, save itself as form; it merely transforms all the matter of recipience from sense into reason, and so rationalizes experience under the supreme causal conception: and this, in truth, is philosophy in its widest sense.

This reason-movement, however, is not a one bald-headed act; it is a process. The various steps of the process, each one of which must be taken if the end—truth, knowledge, or science—is to be reached, have been explained in previous chapters, (Vid. Institutes), viz., percipience of the individual, concipience of the many in a one "thing," the gathering of "single things" into a general concept in the search for the essence of things, the relating of these through the syllogistic process and the causal category, which last is the implicit purpose of the whole movement. Thus the matter of recipience is, by a pure activity, affirmed, coördinated, and correlated into a rational whole.

To what extent and how does the emergence of this mind-energy affect the doctrine of assimilation? The answer is, that the process of organic growth is generally the same. A sensate

in becoming a percept has its facts emphasized and a nail, so to speak, driven through it into the conscious subject so that the remembrance of it is made more secure. But the material to which new matter is to be assimilated is now represented (not by the vague associated aggregates of sensation but) by the resultant products of reason intromitting with the matter of recipience, viz: individual concepts, general concepts, and the synthesis of the syllogism and of causal relation. A new experience is taken into these respectively, if like; if unlike, it is rejected or, if already there by some error, it is thrown out. The general rule is that we assimilate the new to already existing concepts and reasonings. Thus the truth of things is attained—a long process as the history of thought and of science shows, but not a futile one. By assimilation and negation, *i. e.* by analysis, assimilation, and negation, a true synthesis is finally attainable.

Two agencies, we thus see, are operative in the building up of man-mind, viz: (*a*) The inner organic movement or process of assimilation whereby, like the building up of cells in the plant, there is dynamically built up or absorbed into the conscious subject as recipient, and fused into like masses and series by the help of reflex activities, all of non-subject that is within the range of each individual: and (*b*) the formal will-energy whereby we weave our formal selves or dialectic into what we thus receive and have rudely organized, and so construct the temple of knowledge out of the bricks and mortar of associated and assimilated sense-data. The man who could trace, step by step, the dynamic process of assimilation and the subsequent interweaving of the dialectic, would have a vision which would yield a final criticism of knowing.

Educational Reference.—The principle of method here is the same as that yielded by assimilation on the sensational plane.

Suggestion; or Dynamic Recurrence

The process of the building up of mind, we have found, has to be considered in itself both as an attuitional or real process

and as a rational process. That process we have found to be the presentation of a "difference" (a new thing) as a negation of the existing content of mind and the integration of that with the existing content so as to widen and deepen that content. But we have also found that a new thing, a difference, a negation, may find no community with the existing content and stand outside as an isolated fact awaiting more material whereby it may be connected with the content of mind and enter finally into its contexture as a real whole. At the attuitional stage of mind-building, this isolated fact tends to fall out altogether, but at the rational stage it may be seized upon purposely and affirmed and so held *in retentis* till it finds an explanation through the accretion of fresh material. On the other hand, new facts that cohere with the existing content find that they share in the permanence of all the facts already in mind with which they cohere. They all seem to stand or fall together in memory.

Hence we say that any one fact or element in a mass of real content tends, when it arises in consciousness, to suggest or recall the other facts which go to constitute the whole.

The expression "association of ideas" is an unfortunate one and has led to much confusion which, in so far as I can ascertain, lies in the treatment of the subject and not in my own incapacity of understanding. The word "idea" is used in the sense of the recurrence as an "image" of what was first of all a presented reality. The vocable which states this fact of mental experience and begs no questions is "representate." not "idea."

If this be so, the general law is simply this: *Representates tend to recur in consciousness in the relations in which they primarily occurred as presentates.*

Consequently, if *a b c* occurred together or in relation in consciousness the emergence of *a* in consciousness will suggest *b c*, and so forth.

A gun fires, and I am told that it is a signal from a ship in the roads which wants a pilot. When a second time I hear a gun firing, there arises the presentation ship and the putting off of a pilot from the end of the pier.

And this is simply to say that *the related elements* (or parts) *which originally went to constitute a whole in consciousness have a tendency to suggest each the others in representation, and that also a whole suggests the parts.*

Now, what are these original relations? They are the relations of space and time coincident or sequent; or *the rule of contiguity.* Or, they are the relations of likeness which lead to assimilation into connected wholes; *the rule of similarity* (*a*) sensational; (*b*) rational. They are the relation of negation or contrast; or *the rule of contrast.*

E.g., the presentation or re-presentation of a ship tends to stir into consciousness the parts of a ship, and again the sight of a large anchor tends to suggest a ship. Our troops are now on their way to Khartoum. This suggests the desert and all its characteristics, Gordon and modern politics, ancient Egypt and its constant wars of defense in the same unsettled region, and so on indefinitely until the series is interrupted and diverted either by some external occurrence or an act of will. All these are real, or inner associations.

Again, time and space are elements in all experience: consequently, a certain point of time or space will tend to suggest a past experience as having occurred at the same hour, day, week, etc., or in immediate sequence, or at the same point of space. These temporal and spatial associations are external — speaking generally. I say speaking generally, for the vast majority of time and space suggestions have no real connection with the thing or event, while some of them again are real, *e.g.*, 1688 and the English revolution have a real connection. So with the position of the sun and midday.

Further, we may *artificially* associate things and events which have no possible real connection. This external association is effected purposely with a view to taking advantage of the mental fact that *a* is by itself and in isolation difficult to remember, but as linked with *l*, *m*, or *z*, it borrows the memory strength of each link. The memory of each member of a series is strengthened by all the other members, and the one link occurring tends to suggest the others.

Having spoken generally of the subject of suggestion we may now summarize the rules.

Past experiences suggest each other

(*a*) On the attuitional or sensational plane:

1. As having been externally related, *i. e.*, through contiguity in space and time, coincident or sequent. (But space and time may be real relations, *e. g.*, 1688 and the revolution in England.)
2. As being real relations of likeness.
3. As relations of contrast.
4. The whole in synopsis suggests the parts and the parts suggest the whole, *e. g.*, the appearance of the gamekeeper will suggest a whip to the dog.

(*b*) On the reason plane:

1. As parts of each other in the unity or synthesis of:
   (*a*) An individual concept; *e. g.*, cow suggests the parts of a cow and *vice versa.*
   (*b*) A general concept; *e. g.*, "cow" suggests the individuals which enter into the concept and *vice versa.*
   (*c*) A syllogistic reasoning, inductive and deductive; *e. g.*, the premises suggest the conclusion and the conclusion suggests the premises.
   (*d*) A causal relation; *e. g.*, cause suggests effect and *vice versa.*

A rational being may also, I have said, with the purpose of remembering, constitute an artificial and external association of one thing with another; *e. g.*, the War of the Roses and the Seven Years' War with the joints of the middle finger or anything else, and so facilitate the remembrance of the former by making it a part of an artificial series. Any part of that artificial series may suggest the others.[1]

I repeat that writers have often confounded the process of building up the real of mind sensationally and rationally with what are, at best, only the rules of suggestion belonging to the

phenomena of memory—a question which arises only *after* assimilation has done its work in building up the real of mind.

If we keep our eye fixed on the function of assimilation in the building up of our experiences we shall see that there cannot but be a tendency (given the preconditions of memory and imagination) to reinstate a whole experience as it originally entered consciousness when a part of it forces itself, from any cause, into consciousness; and *vice versa*. We should be surprised if it were otherwise.

Further, I would repeat that the distinction between attuitional suggestion and rational suggestion has not been noted, so far as I know.

Suggestion both on the plane of attuition and of reason is alike dynamic. That is to say, it is not dependent on the intervention of will-reason but arises of itself. It belongs to the process of *reminiscence*. We certainly take advantage of this natural and dynamic tendency to recall the past, but this is a free act of *recollection* and is outside the sphere of the merely dynamic tendency.[2]

Now what have we found as a matter of fact? (1) That the real or body of mind is built up by assimilating the new to

[1] All the rules of suggestion might be reduced to one, viz.: What has been once together as a whole of experience, remains together. But it is none the less necessary to ascertain the various *ways* in which the parts suggest each other.

[2] A question here suggests itself. Rational beings can form purposes, and with a view to certain ends, set up in themselves a train of more or less coherent representates of past experience. But when we have no conscious purpose but allow ourselves to be the victim of the inner play of suggestion, we know that we are largely dependent on the external stimulus of some actual presentation to start the train, and that the sudden introduction of a fresh presentation will divert the current into fresh channels. The question is, Does a train of suggestions ever arise in consciousness save at the bidding of the external stimulus of some actual presentation?

The phenomenon which we call dreaming, when our avenues of communication with the external are closed, shows that it is possible for a train of representates to start itself through the inner activity of the cerebrum. But this is, so far as mind or consciousness is concerned, an external stimulus. I have endeavored to show, elsewhere, that in our waking hours one consciousness may suggest another consciousness which is mediated through the cerebral tissues but not *caused* by its activity. From which it would follow that a consciousness (not a self-consciousness) may equally arise in our sleep and start a series. But generally speaking (I

the already existing content, sensational or rational, so as to make one context or whole; (2) that, as was to be expected, the new is easily remembered if it enter into the context and is assimilated—in brief, if it is a real or inner association; (3) that the external associations, whether of space or time, and also the artificial do not contribute to the real context of mind save in a subordinate sense, and are not so permanent and so readily recalled. They lead nowhere and enter (as such) into no whole.

The consideration of the rules of dynamic suggestion yield no fresh principles or methods of educating the mind which are not already yielded by the principles which flow from the process whereby mind builds itself up; but they confirm the rule that we should connect the lessons we give with as many relevant associations as possible.

Let us now endeavor to discriminate the general functions of mind, first, as restricted by natural dynamics, and secondly, as affected and transformed by the introduction of the formal process whereby the natural is lifted into the sphere of the rational.

UNIVERSITY OF EDINBURGH S. S. LAURIE

(To be continued)

think we have noticed) we are dependent on external stimuli for a train of representations. Further, that when we form a purpose to break in on a train of consciousnesses with a view to the execution of some act or following out a certain concentrated line of thought, we are dependent on an irresponsible train of associations for suggesting the purpose. But the purpose once subsumed by self-consciousness is then (but only then) master of the situation and resists the ever-repeated solicitations of diverting trains of association.

But what of non-rational beings—the animal or infant-man of attuition? I think it follows, from what I have said of rational beings, that a consciousness may here too arise and start a train without external stimulus. But there is this to be noted, that there are grades of consciousness, and that the lower the grade the greater is the dependence on external stimulus—the more is the mind-organism a mere reflexing surface for the play of nature. This is the condition in which the rational being constantly is when wearied and yielding himself up to rest.

PREPARATION FOR COLLEGE IN HISTORY[1]

FROM a study of the questions and examination papers submitted to us during the last year we find that there exist in the schools connected with the university a few well-defined methods of teaching history, a brief characterization of which may be of service to us.

What may be called the "discussive" method is in use in some schools. This method emphasizes the expression of individual opinion, and the *discussion* rather than the *acquisition* of facts. The questions set for examination are broad and general: "Discuss feudalism," "Compare Spartan and Athenian institutions;" questions the preparation of which involves little labor on the part of the teacher and which permit the pupil to cover a large space of paper with a very small amount of definite knowledge. Another favorite form of question of the discussive method is: "What might have been the result if everything had been different?" "What would have been the result if Karl Martel had been defeated at Tours?" "We would now belong to the Semitic instead of the Aryan race, and would be polygamous Mohammedan Turks, worshiping many idols instead of Christians worshiping the one true God," is, if not a typical answer, at least one actually given. And since no one can prove what might have been if everything had been different, one such answer is about as good as another. We do not mean to say that discussion is not necessary in teaching history, but young pupils may easily be trained to talk in a wiseacre fashion about things which they do not understand and of which they have no accurate knowledge.

Closely related to this discussive method, in that it emphasizes the expression of individual opinion, is one that may be

[1] This is the fifth article in the series prepared by the Departmental Examiners of the University of Chicago.

called the "authoritative" method. The examination papers sometimes present this method in the form of undue emphasis upon the opinions of the teacher, which we may call the "pedagogical authoritative." This form appears most frequently in papers on American history, in which the opinions of an entire class are found to be warped into conformity to some political or economic hobby of the teacher. Another form of this method places undue emphasis upon the opinion of the pupil. This, at first sight, resembles the "discussive" method, but there is a great difference between them. For while the good-natured teacher of the "discussive" method allows the most untrammeled and irresponsible expression of opinion, the more thorough and conscientious teacher of the authoritative method impresses on his pupils a sense of responsibility which is sometimes almost painful. "Do you favor the acquisition of more territory by the United States?" asks one teacher. And a young girl answers: "I think it a question in which each one is responsible for what he says. At times I think the government has all the land it can handle well, and again, at other times, I think the growth of the country may demand the acquisition of more territory." This answer is taken from a set of papers that were in many respects excellent, and certainly a teacher who is able to impress his pupils with so strong a sense of responsibility is worthy of praise. But such a method of instruction tends to beget in the pupils a too hasty judgment and a sense of easy superiority which dismisses all questions with a cheap and ready-made opinion. The question in regard to the authoritative method is not whether the teacher shall dominate the minds of his class, nor whether the class shall have the privilege of expressing their opinions; for, of course, both are essential to all good teaching. The only question is: To what extent should the teacher permit his hobby or individual theories to dominate his work in preparatory schools, and to what extent should the average preparatory pupil be encouraged to emphasize and insist upon his own opinions?

But a method requiring far more serious attention than any

yet mentioned, and which, from the very nature of the subject, will probably always be the bane of historical study from the grammar school to the graduate school, is the "cramming" method. By this I do not mean simply a hurried or superficial preparation for examination, but a method by which materials are taken into the mind, or rather the memory, without proper comprehension and assimilation. The examination papers show two well-defined forms of this method, which we call the "tabulated cram" and the "detailed cram." The "tabulated cram," from an æsthetic point of view, furnishes the most perfect work which we receive. Both questions and answers are arranged in the most compact and systematic way. They are often models in form and neatness. By means of tables and braces and other conventional arrangements a most surprising number of facts may be remembered, each in its proper place and order. The results of the detailed method are even more surprising; for in this the most detailed and minute facts are enumerated in mere chronological order, without any apparent helps. "Give in detail, with dates, the events of the Peloponnesian War," is a sample question of this method, and endless lists of dry facts, which certainly meant nothing to the pupil, make up the answer. This detailed method shows that the pupils may be made to stow away any number of facts by the aid of the memory alone. When students who have been trained in this way enter our classes in the university, we have to tell them that for the study of history their memory is the least valuable faculty which they possess. The question concerning both methods is not whether the methodical arrangement of facts may not be helpful in the teaching of history, but to what extent details may be profitably taught in preparatory work; and the still more important question, which is the test of all methods: "How shall details and all historical truth be prevented from becoming mere dead facts, stored in the memory, instead of living realities apprehended and assimilated by the reason and imagination?"

The last method of which I wish to speak is often called the "natural" method. It is a method by which the most important

facts and events are put before the pupil in a vivid, living way, thus making use of, and developing, his historical imagination; the causes and effects of the facts are explained and shown to be the important thing, so that the pupil's reason is kept active. He learns that facts are important to the historian only as they have a meaning and as they may be brought into living connection with their time.

In the papers of this kind which we receive the arrangement is usually clear, because the facts are clearly apprehended. The answers are not all cast in the same mold. In these papers the teacher is not to be seen except by his work; nor is the egotism of the pupil, in evidence. What we do see in such papers is the live pupil, with his definite knowledge and lively appreciation of the subject.

There is evidence that the teacher has adapted his instruction to the pupil's capacity; consequently the pupil has properly comprehended the matter and made it his own. Where the instruction has been of this sort, each pupil expresses his answers in his own way, and not in the way of his teacher, or his text-book, except in so far as the correctness of the facts is concerned.

If we are to obtain the best results in our preparatory schools, we should agree substantially in three things, namely: (1) the object to be kept in view in teaching history in preparatory schools; (2) the amount of time to be devoted to each subject and the point of time in the course when the study of each subject should be begun, and (3) the text-books best adapted to the work.

The principal object in teaching history in the preparatory schools is that the pupils may acquire historical knowledge; that they may become acquainted with the great peoples of the world, with the general course of history, with the development of, and the contributions of the various peoples to, the civilization of the world, and with the great men who have been leaders in any important field of activity. Young pupils are not able to become "original investigators" in history. One should acquire a good knowledge of history, of the common results attained by

good historians, before one can undertake with profit the work of original investigation. The more one knows about the general course of history, the better one is prepared to specialize in the subject. "To him that hath shall be given" is especially true in the study of history.

The course of history is, on the whole, continuous and progressive. The preparatory pupil should, therefore, learn the most important facts, that is, facts that are typical, representative, and, therefore, illustrative of the progress made. Little or no time should be spent on hobbies or disputed questions. Nor should undue emphasis be put upon one period or on the work of one man. The instruction should be of such a character as to employ equally the memory, the reason, and the imagination of the pupil. Incidentally many sound principles of historical investigation may and should be taught, the value of sources and their proper use, the difference between good and bad sources, and many other things of a kindred nature. But these should not be allowed to usurp the place that belongs to the acquisition of a knowledge of history itself.

OLIVER J. THATCHER

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METHODS OF ATTACK OF ORIGINALS IN GEOMETRY[1]

APART from all considerations of method, two things are necessary for satisfactory work in the solution of "original" propositions in geometry. First, a thorough knowledge of fundamental definitions and propositions. If the proof of my proposition depends upon the fact that two triangles are congruent, I must be able to recognize the relation without referring to my book, or it is likely to escape my notice. I must know, further, exactly how to prove triangles congruent. To this end, it is well to generalize theorems. The theorems concerning congruent triangles are all contained in the general theorem: Two triangles are congruent if any three independent parts of the one are equal to the corresponding parts of the other, except in the ambiguous case. It is well to make a summary of theorems which are of constant use, but cannot be united in a general theorem. We are often called upon, for example, to prove angles equal in the course of a demonstration; the methods of doing this must be at our fingers' ends, and some such summary as the following may help:

TESTS FOR EQUAL ANGLES.

1. By construction.
2. Vertical angles.
3. Supplements or complements of equal angles.
4. Corresponding angles in congruent or similar triangles.
5. Opposite equal sides in the same triangle.
6. Made by parallel lines,
7. Central or inscribed angles on the same arc, etc.

The second requisite for good work is a geometric imagination. This is necessary to see relations, even when all needed lines are drawn; it is even more necessary to determine what

[1] Proceedings of the Michigan Schoolmasters' Club.

extra lines are needed. I believe it is absolutely useless for one to work on "original" propositions who has no geometric imagination. But the trouble is more likely to be an undeveloped imagination; it needs exercise, such exercise as may be obtained from a frequent application of the principle of continuity.

As to methods proper: We are always given a definite thing to prove or a definite thing to do. We are required to prove, for example, that the angles opposite the equal sides of an isosceles triangle are equal. There are a great number of things which are true of an isosceles triangle; we want a particular one of those truths. How can we avoid, for the time being, those which we are not seeking and go straight to the one we want? The only way to do this is to begin at the conclusion, to assume this either true or false, and reason back to known facts. This method is not confined to geometry; it is the method of every science and of everyday life. This is the one and only method of attacking an "original" in geometry, the method of analysis. Euclid defined it as follows: "Analysis is the obtaining of the thing sought by assuming it and reasoning up to an admitted truth; synthesis is the obtaining of the thing sought by reasoning up to the inference and proof of it." The *reductio ad absurdum* would not come under this definition, but there is no difference in the essence of the method. I shall include it under the head of analysis, and extend Euclid's definition to read: "Analysis is the obtaining of the thing sought by either assuming it true or false, and reasoning up to an admitted truth or falsehood." Analysis, as defined by Euclid, is not conclusive unless the converse of every proposition involved is true. To remove all doubt, the Greeks generally added a synthesis. The modern form of analysis, the method of successive substitutions, so states the case as to avoid the necessity that the reasoning be reversible. We reason as follows: We wish to prove A true; if B is true, it is true; if C is true, B is true; but C is true, therefore A is true.

I feel so strongly the importance of this method of analysis that I trust a slight digression may be pardoned. I know of no text which in any way emphasizes the method of analysis in the

treatment of its text demonstrations. I believe the analysis should be openly recognized as preceding the synthesis. I make a plea for it as a matter of teaching. When we insist upon students knowing exactly what they are to do, when we ask them to bear in mind what they are trying to prove, we are really asking them, in their own minds at least, to start at the conclusion and reason backwards. The brighter part of a class instinctively and unconsciously uses the method of analysis, and, if there is any philosophy in teaching, it should bring out into the open this process which is now so largely simply instinctive and unconscious. I do not wonder that demonstrations are committed to memory. Even when the reasoning is followed and the student sees that the proposition is proved, the steps may seem perfectly arbitrary and be a mere matter of memory. I remember that, as a student, I greatly admired the man who first inscribed a regular pentagon in a circle. How he ever thought of so improbable a thing as dividing a line into extreme and mean ratio was more than I could see. I learned as a perfectly arbitrary fact that to construct a regular pentagon it was necessary to divide a line into extreme and mean ratio. Let us look at this proposition from the other side; let us start with the regular pentagon. If we draw the diagonals, we shall have a number of isosceles triangles, whose equal angles are each double their third angle. We can readily see how to construct the regular pentagon if we could once get this triangle. Our problem is now reduced to constructing an isosceles triangle such that each of its equal angles is double the third angle. We now suppose that we actually have such a triangle and look for a relation between the lengths of its sides; we are led straight to the conclusion that, if one of the equal sides is divided into extreme and mean ratio, the larger segment is equal to the base of our triangle. This is no longer an arbitrary process, it is no longer a matter of happening to turn out right. I know why the old Greek divided his line into extreme and mean ratio. I welcome the introduction of "original" propositions into our courses, because it is forcing this powerful method of analysis

into clear recognition. As a means of mental training, as a method of discovery, the method of analysis stands preëminent; the method of synthesis excels simply as a means of exposition and persuasion.

When we are given a problem in elementary plane geometry (I confine this analysis to plane geometry to save time), we are asked to determine one or more points, one or more straight lines, or one or more circles. We have a straight edge and compasses to work with. To draw a straight line with a straight edge, we must have two points. To draw a circle with a pair of compasses, we must have one point for its center and two points the distance between which will give us the radius. In the last analysis, then, the solution of any problem in plane geometry resolves itself into the determination of one or more points. How can we locate points on a plane? For example, how can we locate a point on this page? We might locate it by saying it is six inches from the top and two inches from the right-hand edge. If it is six inches from the top, it is somewhere on a line parallel with the top and six inches from it. If it is two inches from the right-hand edge, it is somewhere on a line parallel with that edge and two inches from it. If it fulfills both conditions, it must be at the intersection of these lines. We have located our point by the intersection of loci, and I venture the assertion that our only method of locating a point is by the intersection of loci. The solution of every problem involves directly or indirectly the intersection of loci. For example, we are asked to bisect an angle. With the vertex as a center and with any radius we describe a circumference (a locus); this intersects the two arms of the angle (other loci) and determines two points. With these points as centers and with the same radius we describe two circumferences (loci); these intersect and determine points, etc. It should be remarked that this method of intersecting loci is not a different method from that of analysis. It is simply a device or submethod. We must use analysis to find what loci we want.

We are sometimes asked to find the locus of a point fulfilling

a given condition, and in order to apply the method of analysis we must first know what the locus is and then find our proof. Suppose we have no idea of what the locus is. Our first object is to find the shape of the locus. We must make a careful drawing on paper, determining a number of points on the locus, and then join the points by a smooth curve. We can now guess what the curve is and apply the method of analysis, noticing carefully any peculiar points, for they are liable to throw light on the demonstration.

There are other submethods which analysis sometimes suggests. Such are the application of symmetry, superposition, folding, parallel translation, and turning of part of a figure through an angle. The essential point in all of these, except the application of symmetry, is the fact that a figure or part of a figure may be moved about in any way we please. We can subject such part of our figure as we see fit to a simple translation, a simple rotation, or a combined translation or rotation. I think it is better to express this in its general form. In the application of these devices the geometric imagination may find ample range. A happy inspiration will now and then suggest a simply elegant proof.

In conclusion, the one general method of attack is the method of analysis. But mere method is useless; it must be accompanied by a geometric imagination and a thorough knowledge of fundamental definitions and demonstration.

HIRAM B. LOOMIS

NORTHWESTERN ACADEMY

THE HOLIDAY CONFERENCE OF 1897

THE Thirteenth Holiday Conference of the Associated Academic Principals of the State of New York, was held at Syracuse, Tuesday, Wednesday, and Thursday, December 28–30, 1897. The meeting was by far the largest in the history of the organization. At the morning session (Wednesday) the great assembly-room of the high school was crowded, and in the afternoon, though the meetings of the science group and the teachers' training classes group filled the two large rooms which had been assigned to them, the assembly-room, where the English group met, was still comfortably filled, the attendance at this one group being larger than that of the entire conference at many previous meetings.

As on all previous occasions, the social side was given due prominence. The programme provided for an informal meeting and registration in the lobby of the Yates Hotel, at 5 P.M. Tuesday. The attendance on this occasion was very large. At the same place State Superintendent of Public Instruction, Charles R. Skinner, called together some of the most prominent educators of the state to perfect plans for the erection of a memorial to the late Principal Sheldon, of the Oswego Normal School. At this meeting an association was organized to be known as the "Sheldon Memorial Association," and the following officers were elected: President, State Superintendent C. R. Skinner; Secretary, H. R. Sanford; Treasurer, ex-Senator George B. Sloan.

The following committee was appointed to devise ways and means: Hon. Charles R. Skinner, John M. Milne, of Geneseo; T. B. Stowell, of Potsdam; I. H. Stout, of Geneva; A. B. Blodgett, of Syracuse; Dr. O. D. Robinson, of Albany, and C. E. Franklin of Albany. Later it was announced that the committee had decided that the memorial should be either a marble or a bronze statue of Dr. Sheldon. In the former case it was proposed to

place it within the state capitol at Albany, in the latter case, in the grounds of the capitol. To erect such a memorial, it was estimated that $10,000 would be necessary, and it was proposed that the money should be raised among the school children and educators of the state, and paid in during Arbor Day week.

The reception, which the chancellor and faculty of Syracuse University gave in Crouse College Tuesday evening, was largely attended.

The first business session was opened Wednesday morning with a brief address of welcome by the president, Oscar D. Robinson, in which he expressed the sense of loss which the conference had sustained by the death of Principal Sheldon. The usual reports of standing committees followed. Among these, Principal Lyttle, of Watertown, submitted a report on annuities for teachers, in which the following recommendations were made: "That the Annuity Society should be formed, that the membership should be purely voluntary; anyone withdrawing should forfeit its benefits; the state treasurer to be the custodian of the funds; applicants should present a certificate of good health; a graduated rate according to age should be made; there should be no difference in rates on account of sex, and that membership in any city annuity society should not debar anyone from the state organization." The report was accepted and the committee continued.

The first topic for the morning was as follows: "Is the preparation made by the grades for admission to the high schools satisfactory? If not, how can it be improved?" The discussion was opened by Principal Lyttle, of Watertown. He answered the question in the negative, and criticised in particular the course in arithmetic as unnecessarily prolonged. The study of geography, too, was made uninteresting, while history was neglected, and the work in general deficient on the score of moral training. The responsibility for the unsatisfactory state of things, the speaker thought, was to be charged, first, to deficiencies in the teachers on the score of knowledge, experience, and personal character, and, secondly, to the unsatisfac-

tory organization of the teaching force. In the discussion which followed, the subject of arithmetic received much attention, the prevailing opinion seeming to be that much superfluous matter was included in this subject. The introduction of Latin into the primary course was also referred to, and opinions seemed to be somewhat divided as to the practicability of putting this subject into the common schools.

After a brief recess it was announced that Professor Bennett, of Cornell University, would open the discussion of the next subject: "Latin and Greek in the High School Curriculum," which the programme announced was to be discussed on the basis of the "Report of the Committee of Twelve of the American Philological Association." Professor Bennett began the discussion by pointing out that the first statement in the Preliminary Report of the Committee of Twelve was not strictly accurate. It seems to be stated therein that the Philological Association directed its Committee of Twelve to draw up their model programmes in response to a request made by the National Educational Association at the Buffalo meeting in July 1896. The facts of the case, as shown by Professor Bennett, are, that the request emanated not from the National Educational Association as a body, but from the joint committee on college entrance requirements of the departments of higher and secondary education of the National Educational Association, and was made at a meeting at which only six of the ten members of the joint committee were present.[1] Further, model courses were not asked for, but only recommendations of a general nature. It was, therefore, not exactly accurate to assume that the National Association was responsible for these programmes. The speaker then proceeded to criticise the programmes in

[1] This statement is an entire mistake. It is unfortunate that Professor Bennett should have made it, and amazing that no one in his audience should have corrected it. As a matter of fact the motion to invite the American Philological Association to prepare programmes for Latin and Greek was presented and adopted in a joint meeting of the Department of Secondary Education and the Department of Higher Education, with an attendance of between eight hundred and a thousand, one of the largest gatherings of representatives of higher education ever assembled in the United States. —[ED. SCHOOL REVIEW.]

general, expressing himself as feeling no sympathy with the attempts to impose a detailed sequence of study. Such a procedure made teaching mechanical and method superior to knowledge. Professor Bennett closed his paper with a criticism of certain details of the programmes.

Dr. J. W. Scudder, of Albany, followed with an address on the teaching of Latin in the secondary schools. In the course of his remarks he advocated the introduction of Latin into the grammar school and this brought on a renewal of the discussion of this subject, in which many more opinions favorable to the innovation were expressed. Of interest in this connection were the remarks of Principal Bartlett, of Auburn, who reported the successful introduction of the study into the grammar schools of his city.

Following the innovation of last year the Conference held its session Wednesday afternoon in three groups. These were, 1. English in the high school; conducted by Principal Chas. W. Evans. 2. Teachers training classes; conducted by Principal Frank J. House. 3. Science in secondary schools; its scope and method; conducted by Professor E. W. Wetmore, of the State Normal College. The proceedings of the several groups are best summarized by the following resolutions, which were reported to the Conference at the Thursday morning session.

The English group reported as follows:

That the lack of harmony in regard to English teaching is due to two causes: First, to the fact that new aims have recently appeared to the teachers of English, and, secondly, to the fact that the colleges have made a great diversity of requirements.

That the best methods of teaching English are yet to be found.

That every recitation should be made to contribute to good English.

That much oral composition and topical recitation may profitably be called for.

That a large amount of poetry and literature adapted to the age of the pupils, should be studied in the grades.

That English should always be regarded as a means, not as an end.

That English should be considered of first importance in the high school and it should not be dropped nor abridged for less important subjects.

That the present demands for English are not excessive.

That daily practice in writing English is desirable, but that the written work should be distributed among classes in other subjects.

That the study of nature is necessary for the highest literary appreciation.

That the discussion of the larger principles of literary criticism will greatly add to the pupil's interest and form of the basis of much valuable composition work.

The following resolution was reported to the Conference by the science group:

Resolved, That in every high-school course the equivalent of five periods a week for one year should be devoted to physics.

The group on Teachers' Training Classes, reported the following resolution, which was adopted among the resolutions of the Conference:

Resolved, That it be the sentiment of this conference that a certain fixed sum of not less less than $500 be granted by the state to every school maintaining a training class.

Wednesday evening President M. W. Stryker, of Hamilton College, delivered an address in the City Hall before the conference and the New York State Grammar School Council. Dr. Stryker is a fine speaker and worthily upholds the oratorical tradition of Hamilton College. His address on education was largely an eloquent plea for the retention of the old-time significance of the A.B. degree.

The first part of the session Thursday was devoted to business. After the reports of the group meetings and the treasurer had been presented the following officers were elected for the ensuing year: President, J. C. Norris, of Canandaigua; Vice President, D. C. Farr, of Glens Falls; Secretary, S. D. Arms, of Palmyra; Assistant Secretary, Jay Crissey, of Belmont; Executive Committee, E. W. Lyttle, of Watertown; Dr. Edward Hayward, of Lockport, and W. D. Johnson, of Cooperstown.

After the business had been disposed of, the remainder of the forenoon was devoted to the topics on the programme. President Booth C. Davis, of Alfred University, discussed the

certificate system for college entrance. The speaker advocated a system of admission by certificate, believing that its success depended on the coöperation and federation of colleges and secondary schools.

The second topic, "History in the High Schools, How Much and in What Order?" was discussed by Professor W. H. Mace, of Syracuse University, who pointed out the different aims that should guide the presentation of the subject in the grammar grades, secondary school, and college.

Superintendent A. B. Blodgett, of Syracuse, gave a brief address on the Principal's Relation to the Community, which was received by the Conference with great enthusiasm and by unanimous resolution was ordered printed for distribution through the state.

Principal Lyttle presented the following report of the Committee on Resolutions:

Resolved, That the study of arithmetic should be simplified, and that the time given to this subject may be somewhat abridged.

Resolved, That the teaching of geography should be greatly improved; that this improvement may be secured by giving greater prominence to relief forms and other physical features as a basis for other work, and that history should be correlated with the work in geography.

Resolved, That the grammar school curriculum should be enriched, but that great care is necessary in making experiments in this direction on a larger scale.

Resolved, That the Superintendent of Public Instruction of the State of New York be urged to encourage the introduction of the study of Latin or some other foreign language in the eighth and ninth grades.

Resolved, That while we approve of a high standard of requirement for admission to colleges, while we do not regard the present requirements as being too high, we deplore and deprecate the tendency of the colleges to attempt to prescribe courses of study for secondary schools like that proposed by the Committee of Twelve, and desire to register our protest against such attempts.

Resolved, That while we desire uniformity in options, we do not desire definite prescription as to either exact subjects or methods for college preparation.

Resolved, That the Associated Academic Principals of the State of New York cordially request the other educational associations of the state to hold

each year a winter meeting in Syracuse during holiday week, thus establishing a general educational reunion with opportunity for full personal acquaintance and conference among representatives of different phases for our common work.

After the transaction of a few other general items of business the Conference adjourned.

F. H. HOWARD

COLGATE ACADEMY

CAN AMERICAN HISTORY BE PUT INTO ALL COURSES IN THE HIGH SCHOOL?[1]

THE educational value of history is now generally recognized, and there is a growing tendency to increase historical instruction in the primary and grammar schools. In a few years all courses of study will include American history, at least in all grades from the first to the seventh or eighth. Dr. Edward Brooks and Dr. W. T. Harris, as quoted in Baldwin's *Psychology*, place the reason-culture value of history the highest among branches of instruction. But aside from this, the practical application of American history study cannot be ignored or lightly esteemed. American history cannot be taught without correlating it with civil government and political economy, and public schools carried on with public moneys owe it as a supreme duty to the state to teach enough political science to send out boys and girls from the eighth grade who know the meaning of *e pluribus unum* and who believe that the "spoils system is utterly undemocratic." Were we now considering the grammar school, it would be proper to argue that the grammar schools could be made more useful than they are by teaching more accurately and more thoroughly the facts in regard to our government. Individual responsibility in the government, the cowardliness of governmental paternalism, the duty of obeying and enforcing the laws, the simple law of supply and demand in the commercial and financial worlds, the mutual interdependence of labor and capital — these are principles which can be grasped by ordinary eighth-grade pupils, if only the teachers themselves grasped them and believed that their pupils ought to have an understanding of them before being passed on to the high school.

[1] Proceedings of the Michigan Schoolmasters' Club.

But we have in mind today the high school, and I apprehend, from an examination of high-school courses of study, that no argument is necessary here either to prove the value and the need of courses in American history and political science in the high schools. If argument were needed, a few forceful sentences from Professor Nicholas Murray Butler's address on "Democracy and Education" before the National Educational Association, at Buffalo last summer, would furnish a better argument than I can make, *e. g.*, "The divine right of kings found its correlative in the diabolical ignorance of the masses." "The educated Greek at the height of his country's development was taught to regard participation in the public service as a duty and a privilege alike." "Failure to understand the political life of a democratic state and failure to participate in it underlie those fallacies that regard the state either as a tyrant to be resisted or as a benefactor to be courted." "If education and training unfit men for political life, then there is something wrong either with our political life or with our education.' "The public education, then, of a great democratic people has other aims to fulfill than the extension of scientific knowledge or the development of literary culture. It must prepare for intelligent citizenship." "I am profoundly convinced that the greatest educational need of our time, in higher or lower schools alike, is a fuller appreciation on the part of teachers of what human institutions really mean and what tremendous moral issues and principles they involve." Now, these thoughts of Professor Butler, if not intelligible to younger minds, are certainly easy to be understood by young men and women in the high school.

I fully agree with Professor Butler that to prepare for intelligent citizenship is certainly one of the aims of public education, and, again, that if our education does not prepare for intelligent citizenship, something is wrong with our education. American history and civil government—the two cannot be divorced—are not the only things a boy needs to study to make him a good citizen, but I am sure that he cannot become a good

citizen without studying these things. I come then to the subject in hand: Can American history be put into all courses in the high school? and I answer that the form of the question is a slur on our high-school courses. American history not only can be put into all courses in the high school, but it *must*. If it cannot be done, something is wrong with our high-school courses. In my judgment, American history should have a place in every course of the high school, even if something else has to be sacrificed. But I do not think this latter alternative is necessary, for my connection with two high schools in the state has shown me that such a course can be provided, and all the requirements of the university met besides. The course of study in the Battle Creek High School includes a five-hour course in American history during the last half of the twelfth grade for all students. The course in the Saginaw East Side High School includes a two-hour course the entire senior year For some reasons, it would be better that this course come before the last year of the high school, but on the other hand the value of the work is much greater to students more advanced in years, and if the grammar school does its duty, as I have already hinted, the high-school course in American history may well be put in the twelfth grade.

I suppose we are all thinking most of the classical course in this discussion, for nineteen out of twenty-five high schools which I know of have such a course in American history as we are talking of for some of their students. But for some reason, either because students who pursue the classical course are not expected to become good citizens, or because they are expected to learn it elsewhere, or more probably because the classical course has been considered harder than the others, American history has been left out of it. But the university's requirements can be met and are being met in all respects by some schools, and political science taught, too. I hope that as a result of this discussion an effort will be made to include it in the classical course of all high schools. Principal Marsh, in his paper before the Schoolmasters' Club last November, showed

that the high schools of this state require on an average nineteen recitations per week. This is too many. American history cannot be added to this amount. The work must be rearranged, especially that in English and mathematics, so as to give time for a two-hour or a three-hour course in political science. The Battle Creek High School requires twenty recitations a week, or did two years ago; this is too many. The Saginaw East Side High School has seventeen recitations, which is more reasonable, and includes two hours of American history in this.

I have a friend, now a junior in the University of Michigan, who graduated from one of the leading high schools of this state in the classical course. He never has studied civil government, either in the grammar school, in the high school, or in the university, and next year he will graduate from the university at the age of twenty-one with only such knowledge of our government as he has picked up by his own industry. This, I think, is not right; it is not preparing young men for intelligent citizenship, and it ought to be different.

E. C. WARRINER

SAGINAW, E. S.

WHAT OUGHT THE STUDY OF MATHEMATICS TO CONTRIBUTE TO THE EDUCATION OF THE HIGH-SCHOOL PUPIL?[1]

PUPILS in a high school seem naturally to divide into two classes, those who end their formal education there, and those who are planning definitely for a college course. It is true that a large percentage of our high-school pupils never attend school after leaving us, while a few continue definite study for some time longer. Whether for each of these a different course of study should be pursued — a different training offered, is still an open question not in the province of this paper to discuss. But whatever difference of opinion may exist as to the studies for each class to pursue — whether they should be for one educational and for the other so-called practical, whenever mathematics is taken up at all, there is quite general agreement that the culture aim should be the same. In this paper we shall, then, treat the high school as a unit.

Arithmetic, algebra, and geometry, with trigonometry for a few in a few schools, constitute the formal high-school work in mathematics.

Were my subject, "The results which we do not reach in the teaching of arithmetic," I could read you a long paper and one eloquent with the deepest feeling. Each September finds me ready to begin the review of arithmetic with my one hundred forty and more seniors. The days are full of hope, and faith is strong that *this time* the outcome will be all that I desire. Each succeeding February brings the written proof of unsatisfactory results, and I am consumed with remorse, only to arise in the fall to renewed hope and its sure-following disappointment.

Perhaps the results that should be reached in arithmetic may be inferred from an enumeration of my own failures.

[1] Proceedings of the Michigan Schoolmasters' Club.

My pupils are not accurate in computation, they do not hold themselves responsible for such accuracy; have no habit of persistently checking their work at each step to be sure of themselves by the way. They are afraid of a fraction. If the result fails "to come out even," they are in despair. If they chance to discover that others in the class get the same result, they take courage, but their own work does not carry conviction, for they have not learned to rely upon their own judgment. They are not sensitive to the reading of a problem and consequently have no basis for a logical method of attack. They fail to see that arithmetic is a part of a great mathematical whole, or even that arithmetic itself is a unified subject based upon a definite and consistent system of notation. They rather look upon it as an aggregation of isolated subjects for the mastery of each of which a separate trick must be learned and remembered. If memory fails, they have no resource but to juggle with the example according to the various tricks which they do remember until they hit upon the right combination.

These are my failures, frankly admitted, but the cause of them is farther to seek than my own faulty teaching three times a week for twenty weeks.

The Grand Rapids schools are doubtless representative in their work below the high school. The study of arithmetic is begun in the fourth grade, continued throughout the grades, prolonged through the first half of the ninth year, and culminates in a three-fifths course for the seniors. This gives to the pupils five and a half years consecutive study of the same text-book, with the promise of a farewell interview later on. In view of this state of things, should we not have less arithmetic in the lower grades, or, at least, less arithmetic that is beyond the logical grasp of the pupils at the time it was given?

The pupils have had arithmetic poured into them and over them; they have been submerged in arithmetic until, when they reach the high school, they are sodden with it. But even then the first act of the high school is to plunge them again into arithmetic, thus destroying the last chance of getting them

dried out into good arithmetical timber by the time of graduation.

If the solution does not lie in a diminution of quantity, then it must come through more efficient teaching in the grades. Just where the fault is must be determined by the supervisors of that work, but something is wrong somewhere, and until the evil is remedied, our high schools can never give to their pupils the education in this branch that is their due. About all that can be accomplished is to arouse them to some sense of their deficiencies, point out the right way, and trust to bitter experience later on to correct the fault.

As to our own school, I am pleased to say that our superintendent is at present conducting some interesting experiments in the grades, looking toward the desired end, so with us there is hope of better things in the near future.

Leaving arithmetic, we enter upon a field of mathematics in which the high school has full proprietorship and consequent responsibility.

Later years have marked a change in the attitude of educators toward the subject-matter to be taught in algebra and geometry. The colleges are clamoring for wider technical knowledge ; they are asking for a change from " the traditional algebra of most of our secondary schools to such instruction as shall make the transition to the reconstructed algebra of the best American colleges less abrupt." In geometry strong pressure is brought to lead into new fields, and we are asked either to accept modern geometry pure and simple or to modernize our old geometry. That this is true is evinced by the number of books that have recently been put upon the market, the prefaces to which all indicate a demand upon the part of mathematicians for such work.

We should listen to all this and give it careful, but conservative, attention. Every teacher of mathematics in our secondary schools will eventually find it necessary to settle this question. Such lines of work should be given to the pupil as shall offer the best all-around discipline, but there is no reason why this same discipline should not accompany strong mathematical work.

The high school has vital reasons for existence other than its preparatory relations to colleges, and its purpose is not primarily to make mathematicians any more than to make specialists in other directions yet, as one of the recent bookmakers has said: "Quite as good exercise may be found in getting somewhither as in walking around the square."

Whatever the subject-matter selected, there should come from the study of mathematics accuracy of work, facility in handling mathematical quantities, and the best possible technical training as far as one goes. If the best results are reached mathematically, there will go with them a certain ethical training which cannot be separated from good work. Good work cannot exist without carrying with it, though unconsciously, perhaps, this same ethical training. No other line of study in our curriculum offers such valuable discipline as does this seemingly dry subject. The classics may approach it and in certain lines be equally valuable, but for a complete setting in order of one's intellectual house, mathematics has no rival. Arithmetic, algebra, and geometry all have their share in the good work, but by none of them can the claim be so well substantiated as by geometry.

It is not in the province of a high school to teach a trade, to produce expert business men, to fit for a profession, or, in fact, to specialize in any direction. Our duty to our boys and girls is to give them such training as shall make possible their development into the best and broadest men and women consistent with the conditions that may surround them after they leave us. If we give to a pupil the right *training*, whether he goes to business or to college, the mastery that he has gained over his powers will enable him to take up the life of either place creditably. The technicalities of business he will soon master, and the wisdom of the school men will appeal to an eager student.

Let us examine for a little the results that mathematics should attain in this direction.

"Order is heaven's first law," and the mathematician's as well, but young people do not naturally fall in with its requirements. Their enthusiasm leads them on with reckless haste to the one

purpose before them, and things are thrown hither and thither to clear the way at the moment. Mathematics is a formalist in the best sense of the word, and when the subject is rightly taught, pupils will unconsciously fall into general orderly habits. They will see, too, that form is not all a hollow show, but that it has a clearly defined value. Pupils who have the habit of solving examples in a slovenly, confused manner rarely stand high in their class. Of course, there will be found here and there a genius, and geniuses know no law, but, in the main, good form in the solution of an example means clear mathematical insight, and such form is often an actual help to correct solution. Different types of examples have each a different physiognomy, and when this is distorted by the caricature of deformed work, the relation to the type is lost. The right study of equations should lead to a ready recognition of such typical relations, and at consequent ready handling of them. Upon this foundation rests the whole matter of formulæ so important in higher mathematics. If form is the foundation of formulæ, it must not be undervalued at the begining of a mathematical course.

In geometry the same care for form should be continued. The time is no more when an untidy, carelessly drawn figure can pass muster with a good teacher, and the argument that painstaking drawing absorbs too much time, is no longer valid. At the beginning, the forming of correct habits may be slow, but, those once established, a pupil will draw a good figure in as little time as an untutored one will take to perpetrate a careless one. A class that is trained to good drawing cannot help advancing more rapidly, for a carefully executed figure will often reveal a mathematical truth which an ill-constructed one only conceals. When a figure is right and clear, it readily appeals to the eye, and the eye, becoming thus the servant of the brain, assists in reaching conclusions, while with a poor figure the brain must struggle to put upon the distorted image the interpretation that shall harmonize with the mental concept.

The orderly workman is the rapid workman, and it is the right of young people to be trained to orderly habits. The

school responsibility in this direction rests largely upon the teachers of mathematics, and I believe that any school in which careful work in algebra and geometry is insisted upon will show, in all directions, the effect of such influence.

That I do not exaggerate the importance of this side of the subject, is witnessed by the new texts in geometry, the best of which call particular attention to the perfection and attendant clearness of the figures in the book, and urge that the pupil shall imitate them.

Again, who has not repeatedly received to a question the answer: "I know but I cannot tell"? The regulation response is: "If you know, you can tell what you know." This is not the truth, for may not one have a reasonably clear mental concept and yet be unable to translate into good English? Children talk in suggestions, using merely a word to label the idea, trusting to your knowledge of language to supply the rest. The high-school pupil will do the same if allowed to, and unless the teacher is ever alert, a class may complete the work and know some mathematics, too, without ever being trained to sharp expression. The accurate definitions of geometry offer the best possible opportunity for drill in this direction, and no training in high-school mathematics is adequate which does not give to the pupil this education in clear expression. The habit thus formed will follow through life, and will give an honesty of expression that the American people stand greatly in need of.

For a long period the mind is receptive only and gives back what it receives in much the same form in which it was imparted to it. The young mind is unthinking and speaks from impulse, not from conviction. But if the development is rightly conducted, the pupil must be roused to watch his own mind, to discover what is actually going on inside his own head, to have faith in his own mental convictions, and the fearlessness to express them.

Do you remember the dialogue that Plato represents as taking place between Socrates and Meno? To illustrate a certain point in their discussion, Socrates has one of Meno's attendants

summoned before him. The boy was a Greek and presumably the average serving lad of the time.

Socrates asks him various questions about the square. The first few he answers correctly and with assurance. Encouraged by his own brilliancy, he innocently follows Socrates' lead. The conclusion to which he finally brings the boy is that a double square comes from a double line. So sure is the boy of his conclusion that he gives now his first answer of any length:

"Certainly, Socrates, that will be double."

Turning to Meno, Socrates says: "And now he fancies that he knows how long a line is necessary to produce a figure of eight square feet. . . . . And does he really know? . . . . He only guesses that because the square is double the line is double."

Then Socrates patiently retraces the steps of the argument. The first sign of enlightenment that the boy reveals is when he meditatively replies to one of Socrates' questions:

"Yes, that is what I think."

"Very good," Socrates encouragingly replies. "I like to hear you say what you think."

Then the instruction continues until the boy begins to reply in the negative, and at last gives the answer towards which the great teacher has been driving him:

"Indeed, Socrates, I do not know."

Again addressing Meno, Socrates says, "Do you see what advances he has made in the power of recollection? He did not know at first, and he does not know now . . . . but he thought he knew, and had no difficulty, but now he has a difficulty, and neither knows nor fancies that he knows. . . . Is he not better off in knowing his ignorance? . . . . If we have made him doubt and given him the 'torpedo's shock,' have we done him any harm? . . . . Now he will wish to remedy his ignorance, but then he would have been ready to tell all the world that the double space should have the double side. Then he was the better for the torpedo's touch."

Geometry is the "torpedo" that should swim vigorously in the high-school sea. When you have made a pupil think of all you

can count it great gain, for even the thinking that may arrive at wrong conclusions is better for the mind than stagnation. You have made progressive strides when you see your pupil thinking independently, and talking out to you his conclusions fearlessly. The best teacher of geometry that I know says that the right results have not been attained until a pupil not only ceases to lean upon the teacher, but is able to stand up against a teacher and argue his case with confidence and in a manner to carry conviction to his hearers.

Of all the high-school studies, geometry alone offers drill in formal logic, so it is here that the mind must be trained to a knowledge of its powers and the proper use of them. Every demonstration should be a faultless argument. The pupil should be taught to ground himself thoroughly upon the hypothesis and then work toward the conclusion by honest logical steps. Through the influence of correct demonstration he will learn to feel the relation of cause and effect, of act and consequence, and to realize the limitations of human power.

Let us trace in a general way the steps of such a demonstration. In the first place, the hypothesis must be carefully isolated. He must see to it that no extraneous matter creeps into it, and that he claims as his own only what honestly belongs to him by gift of the proposition stated, and he must see to it that his argument is based upon the hypothesis. Next he must examine his resources, take an account of his stock in trade, and determine what he can bring of previously tested knowledge to aid in the proof which he has undertaken. Probably he will first say: "Draw such and such lines." Then will come the inevitable "Why?" asked first by the book, repeated many times by the teacher, until the pupil learns to stand sentinel over his own mind, and, challenging every step of his progress, is "ready to give an answer to every man that asketh a reason."

After the figure is constructed, the pupil must examine it. He may discover in it a dozen things, every one of which is true, but only two or three of them have any concern with the business in hand. Let his mind be so trained that these will seem to

spring toward him and all the rest fade into the dimness of indifference. Such training will teach him to select from any group of facts or conditions the central one. It will teach him to seize upon the vital feature in any relation of life. Such a mind will take the tide at its flood and rarely find its life bound in shallows and disasters.

Perhaps in the demonstration it becomes desirable to apply one part of the figure to another. He may lift that part and place one line of it or one angle upon its equal, but there his control over the matter ceases. From that moment he is under law and face to face with the eternal. Let him stand there a humble spectator, knowing that, "Till heaven and earth pass, one jot or tittle shall in no wise pass from the law" over which his finite mind has no control. He was responsible for placing the figures together, but before the resulting consequences he is helpless. He may watch and see if in the finality there is aught that concerns him. Here again he will discover various things accomplished, but again he must recognize the one conclusion for which he has been striving, must isolate it from the rest and hold it up to view with the strength of conviction.

Thus far we have discussed the cold, intellectual side of mathematics, but when that is done the all is not said. You are keeping the minds of your pupils in a prison house if you do not help them burst the bonds of sense and rise toward the infinite.

Mathematics may toil in the mines, it may float upon the ocean the ships of war and of commerce, it may perform any service that man demands. "For whoever will be chief among you, let him be servant of you all." This service, however, does not bind to earth nor to things visible. We begin with the concrete, but unless the imagination is so cultivated that it can eventually sweep out far away from all this, and trace the relation of the unseen to the visible, geometry has failed of its full mission. The things of time and sense are verities, but beyond lie the beauteous palaces of the imagination built upon a sure foundation and rising into the limitless expanse of space. Help your pupils to build these palaces, and into them will silently

glide the spirit of poetry to dwell there forever. Geometry seems to stand for all that is practical, poetry for all that is visionary, but in the kingdom of the imagination you will find them close akin, and they should go together as a precious heritage to every youth.

The picture that Wordsworth gives us in "The Prelude" is always charming to me. Musing one day by the seashore

> On poetry and geometric truth
> And their high privilege of lasting life,

he fell asleep and dreamed a dream. Over a vast wilderness an Arab passed,

> A lance he bore, and underneath one arm
> A stone, and in the opposite hand a shell
> Of surpassing brightness.

He was hasting inland to bury these treasures from the pursuing waters of the deep. The precious stone was geometry and the shell its sister treasure, poetry — the two things in the world that must be saved :

> The one that held acquaintance with the stars,
> And wedded soul to soul in purest bond
> Of reason undisturbed by space or time.
> The other that was a god.

Geometry, in the hands of an inspired teacher, is not alone of this world, but it sweeps to the infinite realm occupied only by the pure imaginings of the geometer and the clear visionings of the poet.

To sum up, then, the study of mathematics should add three things to the education of the high-school pupil :

It should give him thorough training in the facts of mathematics so far as the subject is taken up, and should give facility in the handling of its various functions in computations.

From the ethical side, it should teach him order, give him integrity of thought, honesty of expression, ability to isolate the central point in any issue, and quickness, under all circumstances, to seize upon the thing of vital importance to him at the moment.

From the poetic side, he must learn to be at home in

"An independent world
Created out of pure intelligence."

A boy or girl trained in this wise will be no weakling. He will know his strength, he will recognize his limitations, and he will have a reverent respect for the eternal verities of the universe.

FLORENCE MILNER

GRAND RAPIDS, MICH.

REPORT OF TWENTY-EIGHTH MEETING OF THE MICHIGAN SCHOOLMASTERS' CLUB

THE twenty-eighth meeting of the Michigan Schoolmasters' Club opened its sessions at Ann Arbor, Friday, April 2, 1897. The day sessions Friday were given to the conferences in Latin and Greek, English, history, mathematics, physics, biological sciences, reports of which are given briefly with a few of the papers on the more important topics. Friday evening Professor Paul H. Hanus, of Harvard University, delivered an address on, "What should the Modern Secondary School Aim to Accomplish?" This has already appeared in *The Review*. At the general sessions of the club, Saturday, Professor Hanus read a paper, which was discussed by Professor Klimcksel, of Hope College, on "Preparation of the High-School Teacher of Mathematics." Mrs. Florence Milner, of the Grand Rapids High School, followed with a paper on, "What Ought the Study of Mathematics to Contribute to the Education of the High-School Pupil?" Principal E. T. Austin, of Owosso, discussed the topic further. The session closed with a paper on "The Teaching of Economics in the Secondary School," by Dr. F. H. Dixon, of Michigan University, after which a discussion was participated in by Professor H. C. Adams, of Michigan University; Principal E. V. Robinson, of Muskegon; Principal J. E. Lautner, of Cadillac, and Professor B. A. Hinsdale, of Michigan University. These papers, with an outline of discussions, appear elsewhere.

E. C. GODDARD
Secretary

HISTORICAL CONFERENCE

In the historical conference the chief subject of discussion was the question: "Can American history be taught in all the courses in the high school?" The subject was opened by Professor McLaughlin, who pointed out that it was desirable to consider the question from the practical point of view and from the standpoint of the programme; is there place in the programme for a semester's work in American history? Principals Bliss, of Detroit; Hartwell, of Kalamazoo; Warriner, of Saginaw; Robinson, of Muskegon, and others, took part in the discussion. All expressed interest in the

subject, and all seemed to agree that, if the preparation in Greek required only two years, the university requirements could be met, and American history be taught in addition. There were some differences of opinion concerning the time that could be allotted the subject under present conditions, and the method that could be used.

After the conference had discussed this matter for a time, Professor Hudson explained why a year's work in English history had been included in the new requirements for admission, one of the reasons being that by studying the subject for a year a student could complete in the high school the elementary work that is now done in college.

Mr. Warriner's paper is given as an interesting contribution to the subject first discussed by the conference (see p. 101).

REPORT OF PHYSICAL CONFERENCE

The physical conference of the Schoolmaster's Club assembled in the physical laboratory at 10 : 30. Professor Carhart of the university began the programme by exhibiting two synchronous pendulums, illustrating very nicely sympathetic vibrations. He was followed by Mr. Randall, of Saginaw, who presented some very interesting pieces of apparatus for showing the magnetic field around a wire carrying a current. By using a large number of turns of wire, he was able to produce, with a single Grenet cell, a strong magnetic field. The apparatus would be especially useful for laboratory work.

The afternoon meeting was opened by Professor E. A. Strong of The State Normal School, president of conference, with a helpful paper on laboratory administration. A brief outline is given because the question is of interest to science teachers.

A SMALL school is not necessarily an inferior school. Many of the smaller, or "non-diploma," high schools in our state are taught with intelligence and power. In one or two subjects they are often superior to the "diploma" schools. But they have no tradition of excellence, no steadiness, no continuity, and hence can give no assurances for the future. In a few of these schools the instruction in physics is sound and strong year after year ; in others it is occasionally good ; in many it is always deplorably weak. Of the 350 or so 10-grade, 11-grade, and 12-grade high schools in the state more than 60 per cent. make some effort to have a demonstrative course, and fully one-half of this number attempt to add a laboratory course in physics or chemistry, or both. The difficulties in the way of this laboratory course are so great in a small community that many of these schools have apparently weakened their work by the introduction of laboratory physics. Not only have their graduates less information than formerly concerning physical fact and law, but their ideas are more crude and confused. They should not, therefore, abandon this

laboratory work, but they should be helped in the effort to integrate and strengthen it.

A very common evil is a want of any proper connection or relation between the demonstrative and the laboratory work. Whether two books are used or only one they seem to be two separate subjects.

The physics teacher is loaded down with work. Usually he has from six to ten classes to teach, and often as many subjects as classes. If any laboratory work is attempted by pupils, except at the regular physics period, it must be without the presence of the teacher or outside school hours. This section of the club might very properly appoint a committee to consider what rights should be accorded this subject, and the teacher of this subject, upon the school programme.

More and more there is specialization of duties in the corps of teachers of even the smaller schools, and the physical instruction has profited by this tendency. In our own state the most common combination of subjects is the sciences, so-called, including physics, chemistry, astronomy, physiology, botany, zoölogy and physical geography or geology, or both. The next most common combination is physics, chemistry, algebra, and geometry; physics, chemistry, and Latin is not infrequent; also physics, chemistry, German, and history.

Physics is taught as a leading subject by the principal as often as any subject except Latin, though English and mathematics occupy this position hardly less frequently.

A change in the principalship often, perhaps usually, results in a change in the policy of the school, and the smaller the community the less power school officers and school tradition have to resist this tendency. The sciences suffer especially from this change of policy, as the slow accumulations of scientific material are rapidly dissipated in an uncongenial atmosphere.

The notebook is often used so as to stand in the way of good work. Far too little is made of the direct record of personal observations taken at the moment, and far too much of these results as elaborated and depicted in elegant form during leisure hours.

Laboratory fittings and apparatus are hard to get and easy to lose in many schools; mainly hard to get because easy to lose. The state as a whole expends a reasonable amount annually for maps, charts, apparatus and material, but much is unwisely purchased and more is ill cared for.

School boards, with the reluctant consent of the teacher, make many unwise purchases. The main purchases of material for school use made in many towns are of such maps, charts, cyclopædias, astronomical lanterns, tellurions, orseries, air-pumps, barometers, etc., as are pushed upon them by selling agents. Teachers also order expensive luxuries; apparatus without accessories, and so useless, or pieces having little relation to the actual work of the school.

Apparatus like the above is naturally not cared for and soon gets into the waste-heap. In this way a habit of treating carelessly even such pieces as have some vital relation to instruction is formed. In many schools the annual loss of material from careless handling, from improper use, from neglect, and from unfavorable conditions for use, is excessive. Especially is the want of storerooms, cases, cupboards, etc., a source of waste, loss, and "wear and tear" of scientific material. This section of the club would do well to publish leaflets or circulars calling attention to this matter, and urging that suitable provision for laboratory work be made at the time of the erection of the high-school building.

Teachers do not keep up their reading. The number of foreign and American scientific periodicals taken in the state has never been large, and would not seem to be increasing. Small salaries and little time for reading are usually alleged as the cause for this state of things, but it is much to be regretted.

Superintendent Bemis, of Ionia, led the discussion on the paper and brought out some of the difficulties the teacher of science in the small school has to contend with. Following the general discussion, Professor Carhart gave some Thompson repulsion experiments with alternating currents. A heavy ring of copper was repulsed with such force as to cause it seemingly to overcome gravitation and to hang in the air. The rapid alternations of the current, 280 times a second, caused the ring to become too warm to handle with comfort. An incandescent lamp was made to light, though only held above the coils. Dr. St. John, of the university, next gave some "experiments with the Hertzian waves." He showed the phenomena of resonance, of reflection and of polarization, and finally measured the wave-length. This is the first time these experiments have been performed in Michigan. Mr. Hawkes, of Ann Arbor High School, closed the programme. He exhibited a "modification of Atwood's machine." It makes the machine self-recording, and from the data given, it seems to be a real improvement over the old form of Atwoods'.

At the business meeting, Mr. C. F. Adams, of Detroit High School, was made president of the conference, and Mr. F. A. Osborn, of Olivet College, secretary. The following motion was carried: "That a committee be appointed to ascertain the opinions of physics' teachers in the state concerning the total amount of time needed for the recitation and laboratory work in the subject, and to report a reasonable medium demand."

MATHEMATICS CONFERENCE

OUTLINE OF A PAPER ON THE "PRINCIPLE OF CONTINUITY," BY MISS IDA L. BROWN, YPSILANTI

MISS BROWN called attention to the contributions of Kepler, Roscovich, Poncelet, and Desargues in originating and perfecting the theory; its

remarkable growth in importance during the present century in France, Italy, Germany, England, and our own country; its utility in adding to the interest, awakening the spirit of discovery, and giving a broader view to the whole subject of geometry. The essential features of the theory were illustrated.

Magnitudes, real and imaginary, positive and negative, were treated in the solutions of propositions; all parallel lines were shown to have a common point of intersection at infinity, while a straight line was regarded as a circle with its center at infinity. Propositions, impossible of solution by pure geometry, were solved by algebraical method, and the principle of continuity was applied to show how the elegance of the one method might be combined with the generality of the other.

One of the propositions taken up was that regarding the relation which exists between the similar polygons constructed upon the sides of any triangle, and from this were derived all the special cases growing out of this general proposition.

A DISCUSSION OF THE STUDY OF MATHEMATICS, BY PRINCIPAL E. T. AUSTIN, OWASSO

It is quite generally considered, I think, by psychologists that when any mind characteristic is developed and the nerve cells in some part of the brain are more or less specialized, that this part undergoes a certain change which results in its differentiation. The degree of differentiation depends upon the degree of development of the nerve cells of that part. To quote from Professor Halleck: "Each sensory nerve area exists for the purpose of receiving the proper stimuli from the external world. These centers must remain comparatively undeveloped if they are not properly exercised." Again he says: "An adult may be approximately defined as the sum of his youthful nerve reactions, which tend to perpetuate themselves. Youthful nerve cells are like freshly mixed plaster of paris, and, like it, they soon lose their plasticity." It is a fact known to physical science that when a mass of metal in a car wheel or cannon has been subjected to oft-repeated shocks, the molecules rearrange themselves to conform to the changed conditions. In the same way brain cells change under repeated shocks or stimuli from without. The period when the brain cells readily respond to outside stimuli ends before the age of twenty-five.

If we accept as valid these conclusions of the psychologist, and it seems to me we must, we have forced upon our consideration problems of considerable magnitude, some of which must be worked out by the secondary-school teacher, since he deals with the student at the time when his mind is the most plastic. We owe it to him as well as to the community that we equip him to the best advantage at this time, for we may do any thing that is rea-

sonable with his mind. All subsequent knowledge must be built upon this youthful foundation.

At the high-school age the pupil will not have passed the stage of his life in which memory is stronger than any of the other mental characteristics, and up to the time of entering the high school it is stronger than it will be at a later period. Then up to this time his study of mathematics should have been with the idea of acquiring the fundamentals, rather than with the idea of training the reasoning powers. It would seem better to consider the elements of algebra and concrete geometry recommended by the Committee of Ten than to master arithmetic. Should he stop going to school at the end of the eighth grade, he will have gained much useful knowledge, and should he enter the high school, he is in possession of a part of the routine or mechanical work. Have him memorize some of the working principles of algebra, know how to bisect lines and angles, construct perpendiculars, and understand some of the properties of equality and similarity. Much of the mensuration of arithmetic might be taught as concrete geometry. It will be seen that up to this time mathematics have contributed most to the practical side of the pupil's education, and at a time when it can be done to the best advantage.

During the first and second years in the high school the acquiring of useful knowledge should become a secondary matter. At this period memory is still active and will find many opportunities for its exercise. It is now time to present mathematics in a form that admits of systematic demonstration. This purpose of mathematics should come more and more into prominence as the work goes on. We are to bear in mind this is the only chance the large majority will ever have for training their powers of logical reasoning. A student trained in following a mathematical deduction and with suitable exercises has worked out for himself a sound logical course of reasoning, has gained more power than mere knowledge can ever give. It is the power gained by this rigorous course in logic that will be so helpful when the everyday problems come to him for solution. Too often pupils are led to think that the solution of exercises is the chief end of high-school mathematics, but they should early be led to understand that the main object is an insight into the meaning of the processes involved, and the training in logic. The educational value of mathematics consists less in the amount done than in the way it is done.

As a third contribution of mathematics to the education of the high-school pupil I mention the power of generalization. One is only to remember the impetus given to mathematics by the discovering, in 1540, by Vieta, that when symbols or general characters are used the solution becomes general for all problems of that class. The moment this is fully comprehended by the pupil he is lifted out of the region of particulars into the region of universal truths. A certain bank cashier, when asked by me to

state what mathematics had contributed to his education, replied: "The power to generalize. If it be a problem in computation, I put it into the form of a general equation, apply the usual laws, and know at once I have the solution for the special case. A moment's thought will reveal the extent to which we use the power of summing up or generalizing." In geometry and algebra we have two ways by which this important mind characteristic may be developed. These mathematical subjects have this advantage that when the conclusions are once obtained there are no misgivings that they may prove false at another time.

This consideration brings me to still a fourth contribution of mathematics to the pupil's education — a feeling of absolute certainty and confidence. With what assurance the pupil moves from data to conclusion, from the known to the unknown! Well he knows he is making use of the greatest mental force of which the human mind is capable; and he must know that these are the methods by which at least approximate certitude is attainable in other departments of knowledge. In fact, I deem this so important that I take every possible occasion to impress it upon my pupils. This feeling of certainty in mathematical conclusions has a direct influence on the formation of habits of right thinking, a point well brought out in the first paper.

Finally, it may seem that the study of algebra and geometry has no relation to the welfare of the community. The equation with its tangle of symbolized quantities and geometry with its lines, surfaces, and solids may seem to have nothing to do with everyday life. When the boys and girls have worked out the equations and determined the relations of the geometrical concepts, what will it avail them or the business world? Notwithstanding that the numbers are few who are made broader, deeper, and better by this study, experience shows that the numbers are on the increase and that mathematical study has not lost ground. Through the few, but in a changed form, will the world at large be made better, not by algebra and geometry directly, but by the increased mental power of men and women elevated and made stronger by mathematics.

DISCUSSION OF "METHODS OF ATTACK IN GEOMETRY," BY MARY E. TRUEBLOOD, SAGINAW, E. S. HIGH SCHOOL

I well remember the time when I discovered that there was a systematic method of attacking certain original propositions and have put it down as one of the red-letter days in my study of mathematics. In the high school I never received so much as a hint that there was any way but groping about. It was in the university that my attention was first called to Petersen's book, *Methods and Theories for the Solution of Problems*, which supplied a need I had long felt.

Surely every pupil will consider any method of intelligently attacking an

original as a great find, for no matter how much they may declare that they "hate mathematics," they all find pleasure in thinking out a proposition for themselves. It is usually misdirected or undirected effort which causes the wail we so often hear. The teacher's first concern should be to arouse interest in the pupil, to make him think of his geometry with pleasure, for "pleasurable efforts are the most effective." I have said *arouse interest;* perhaps it would be better to say *keep up the interest,* for I believe that interest in mathematics is the normal condition of children. How to hold the interest is not the subject under discussion, but sometimes a plain truth which you wish to impress may be dressed up in an attractive form. If you give the pupils some problem such as to find a means of measuring the height of a tall building or of finding the width of a river, the result will be more satisfactory than if you talk to them a whole hour upon the importance of the proposition about similar triangles. They like that sort of exercises and discover for themselves the importance of the proposition.

In order to gain facility in solving problems, subjects, or propositions which are fundamental should be dwelt upon and referred to sufficiently to make them part of one's working material. A pupil may be able to explain the two kinds of symmetry (the day that he has symmetry for his lesson) without it ever occurring to him to make practical application of it, or he might know how to demonstrate that "if two variables are constantly equal and each approaches a limit their limits are equal," but might never think of making use of it in an original demonstration if it were not called to his attention, directly or indirectly, that it is most useful in proving many other important propositions.

There are several simple loci which form the key to so many problems that every pupil should become familiar with them as with his a, b, c's Such are :

The locus of a point moving at a given distance from a fixed point.

That of a point at a given distance from a straight line.

The locus of a point equally distant from two given points.

The locus of a point equally distant from the sides of an angle.

The locus of a point equally distant from two parallel lines.

Pupils sometimes give up a problem before they have touched pencil to paper. They are conquered before they make a real attempt to conquer the problem. If diffident pupils can be prevailed upon to go to the board and get the figure before them, they are often surprised to find how simple a problem becomes which at first sounded difficult. A lack of confidence in their own ability has caused many a poor recitation. They will have gained what will be of lasting advantage if they learn not to give up a problem easily, being assured that "no effort is lost though at the time it may appear so." It might be of encouragement to tell them what the immortal Newton said; "I keep the subject constantly before me, and wait till the first dawnings open by

little and little into a full and clear light." A good motto for the teacher is found in the preface of a little book by William Spencer, father of the great scientist: "The inventive power grows best in the sunshine of encouragement. Its first shoots are tender. Upbraiding a pupil with his want of skill acts like a frost upon it, and materially checks its growth."

The questions of the possibility of a geometric construction of a problem is not often encountered by high-school pupils, for the problems presented to them are as a rule capable of solution. The pupil's attention should be called to such simple facts as that no problem can be solved in which a circle is required to fulfill four conditions, or a straight line three conditions; but in general they have no means of determining whether or not a problem can be solved. To the teacher, or to any other student of mathematics beyond that of the high school, it is an interesting question to determine when a problem can be solved by means of the rule and compass. Elementary geometry is not sufficient to determine this, for it has no general method; so we shall make use of algebra and analytical geometry. If a problem, however complicated, can be solved geometrically, it must be composed of the following operations, once or many times repeated: to draw a straight line through two given points and to describe a circle with given center and given radius. Each point is determined as the intersection of two straight lines — two circles or of a straight line and a circle. Expressed analytically, to find the intersection of two straight lines is to solve the equations

$$ax + by + c = 0$$
$$a'x + b'y + c' = 0.$$

The points of intersection of a straight line and a circle are furnished by the set of equations,

$$x^2 + y^2 - r^2 = 0$$
$$ax + by + c = 0.$$

A solution of either set of these equations will give only rational values, or values containing square roots. Since we know how to construct a square root with rule and compass, we may state the following important theorem: The necessary and sufficient condition in order that a problem may be solved by rule and compass, is that the quantities sought may be expressed rationally by means of given quantities and by square roots. Hence, to demonstrate that a quantity cannot be constructed with rule and compass, it is sufficient to show that the corresponding equation does not give values containing only rational quantities or square roots.

A few well-known problems will serve to illustrate:

Required to find the locus of all points equally distant from two given points.

If we take one of these points as the origin, the line joining them as the axis of x, and the distance between them, $2a$, which we may do without destroying generality, the equation of the required locus, $x = a$, is the equa-

tion of a straight line parallel to the axis of y, and the problem is capable of geometric solution.

Again, find the locus of the vertices of all right triangles having the same hypotenuse. This problem may be stated as follows: Find the locus of the point which moves so that the sum of squares of its distances from two fixed points is constant. The equation which expresses this condition is the equation of a circle, and again rule and compass may be used.

Let it be required to place a triangle in such a manner that each of its vertices lies upon one of three given circumferences. If one of the circles be removed, the locus traced by the vertex, freed from the given condition, is found by analytical methods to be neither a circle nor the limiting form of a circle — the straight line, therefore the problem has no solution.

The problem of Delos or of the duplication of the cube, expressed analytically, is $x^3 - 2 = 0$, where the edge is taken as the unit of length. The roots of this equation cannot be expressed by means of square roots nor by rational quantities; hence it is impossible to construct this problem with rule and compass.

The trisection of an angle may be made to depend upon the following problem: From a given point P in a circumference to draw a line which shall intersect the circumference in M and any given diameter in N, so that $M\,N$ shall equal a radius. Leaving the diameter out of account, and considering only the point N, we find that the equation of its locus is of the fourth degree and represents the Limaçon of Pascal. The intersection of the diameter with this cannot be determined with rule and compass, so the problem lies without the scope of elementary geometry.

The application of this method some centuries ago would have saved hours of study for many a mathematician; however, we will not call it wasted time, for in geometry, as in alchemy, a search after the unattainable may lead to results more important than the object of search.

THE BIOLOGICAL CONFERENCE

REPORT ON ZOÖLOGY, BY PROFESSOR REIGHARD, OF MICHIGAN UNIVERSITY

In the discussion of zoölogy teaching, Professor W. H. Munson, of Hillsdale, presented a paper on the teaching of zoölogy in the secondary schools, attempting to answer the questions "what?" "how much?" and "how?" The paper was followed by discussion, which was led by Professor W. B. Barrows, of the Michigan Agricultural College, and in which Professor Jacob Reighard, of the University, and Professor Barr, of Albion College, took part. In reply to the question "what?" Professor Munson assumed, rather than distinctly stated, adherence to the plan of studying a limited number of animal types by the laboratory method. This plan is the one adopted in numerous recent books, such as Huxley and Martin's Biology, Marshall and

Hurst's Practical Zoölogy, Dodge's Practical Biology, and many others. This is the plan pursued in the beginning courses in most of our colleges, and barring the *exclusive* use of the text-book (a method condemned by every competent teacher), is the plan that may be most safely followed by inexperienced teachers. While it demands a certain technical facility on the part of the teacher and a certain range of knowledge, it is very far from necessitating any broad knowledge of the whole subject.

In answering the question "how much?" Professor Munson was inclined to make the number of types studied greater than is customary. To pass from a laboratory study of amœba alone to a discussion of the properties of protoplasm, seemed to him to be a dangerous approach to teaching induction from insufficient data. He would first study several types of protoplasm under a variety of conditions. How time was to be found for so diversified a laboratory course, without the sacrifice of thoroughness, was not made clear, nor was it pointed out that in such cases as the one cited above, the single laboratory type is meant to serve rather as an *illustration* of the general properties of protoplasm than as *proof* of their universal occurrence. A laboratory course of this sort furnishes *proof* enough of certain minor facts and processes, but only *illustrations* of general principles.

What Professor Munson had written in answer to the question "how?" had been so anticipated in the two botanical papers and in the discussion that followed them, that it was largely omitted from the paper as read. Briefly stated, the points insisted on were: (1) A careful training in observation, free from the influence of books, the work of others, or other "predisposing causes;" (2) an accurate record, written and pictorial, of the facts observed; (3) some training in the use of the facts in scientific induction.

In the discussion by Professor Barrows, of the Agricultural College, it was maintained that zoölogists should learn from the teachers of the languages and mathematics. The field of zoölogy is quite as extensive as any of these, yet zoölogical teachers commonly attempt to cover the whole of this field in a single brief course, while teachers of the languages are content to cover a very small fraction of the field in a similar course. It was argued that each zoölogist should limit his teaching to that part of the field with which he was most familiar. Thus, instead of attempting to cover the whole animal kingdom, he would spend his time upon insects alone, or upon molluscs alone, or upon some other limited group. The quality of the instruction would thus be greatly improved, and the study could be made to afford real training to the students. Professor Barrows here seems to have had in mind the teaching of systematic zoölogy, and his remarks should be thus interpreted. On the other hand, it is of course true that by the study of the structure and functions of selected types, the animal kingdom may be fairly well covered in a brief course, after the manner outlined by Professor Munson.

Professor Reighard, of Michigan University, called attention to the fact

that two sides of the subject had been so far brought forward; one the "biological," the other the systematic. He hoped that some adjustment might be arrived at, by which the work of the secondary school could be correlated with that of the college, and inquired whether a considerable part of the systematic work could not be relegated to the lower schools. He believed that the nature-study work of the primary schools could be so conducted as to make the pupils familiar with all the commoner animals of their neighborhood. Competent teachers could bring these animals (often living) into the schoolroom, and students would be interested in them and would easily become familiar with them and even with their scientific names. They would be eager to know of their habits and habitats. Thus a large fund of natural-history knowledge could be acquired with little effort and at a time of life when it would be most likely to make a favorable impression on the student. In the secondary school there could then be a course in the study of animal types, as recommended by Professor Munson. All of this presupposed well-trained primary-school teachers. If such a correlation could be brought about, it was believed that the student would reach the college prepared to take up advanced work. At present the college student must begin at the beginning. If systematic zoölogy is to be taught in the high school at all, the speaker favored a trial of the plan suggested by Professor Barrows, by which instruction would be limited to a single group — the subject becoming entomology, for instance, in place of zoölogy. He further favored a study of zoölogy from its physiological or economic side. The exclusive study of systematic or structural zoölogy he believed to be narrow and believed that more attention should be given to a broader study of the animal in all its relations — the physiological or oecological aspect of zoölogy.

Professor Barr, of Albion College, was unwilling that systematic zoölogy should be taught at all in the primary schools. He favored leaving the entire natural-history work of the schools in the hands of the botanists. His objection seems to have been rather against the formal systematic zoölogy of the books, than against the form of nature-study work recommended by the previous speaker. The latter form of work would aim merely at a familiarity with the members of the local fauna as individuals, introducing only so much grouping as could be made to readily suggest itself to the pupils themselves.

BOTANY — WHAT SHOULD BE TAUGHT? HOW MUCH? HOW? CHARLES A. DAVIS, ALMA COLLEGE, ALMA, MICH.

In teaching botany in the high school at least two factors have to be carefully considered before all others, namely the pupils and the teachers. The pupils are of most importance. They claim our attention first and must be considered as we find them, not as we would have them, under ideal conditions. The average pupils of our high schools, on account of bad, or unwise, and

one-sided training, are usually in a mental condition that is worse than blank when they reach the grades where the elements of botany are studied, for their minds are already bent and twisted, and have become fixed in bad habits of study and thought. They are not as little children for their minds have lost the flexibility and elasticity of childhood and that vivid interest in the world about them which is so manifest in young children. I need not portray the deficiencies of the average pupil from the standpoint of the teacher of botany, for they are familiar to most of us from personal experience. Such as he is, we have him before us and we wish to give him as much benefit as possible, in an altogether inadequate time, by means of a course in botany. The ideal teacher could take this average pupil, and in a few lessons so arouse him, that he would soon become an eager student of botany, or, at least, would be so stimulated that he would get all the benefit which is expected from the course. But here also the factor is an average one, and it is an average over-worked teacher, often without a special interest in the science, and usually without any special training in it, or great knowledge of plants, who comes in contact with the class made up of average pupils. Often a third factor, perhaps equally important, comes into the problem, namely, a text-book. These, then, are the principal factors in the problem before us; pupils not fitted for the work they are to undertake, teachers who have no special preparation, and text-books suited to ideal conditions, all to be harmonized and worked out x equals something, in a period altogether too short for ideal teachers to teach ideal students the rudiments of a great science under most favorable conditions. In most cases, as we would expect under the conditions which we have been considering, the x of our problem proves equal to zero and nothing else. This is not the answer desired, but it is unquestionably the one we get in many, if not most, small high schools, and some larger ones. The reason for this is plain and may be summed up in a few words. The interest of the pupils is not aroused and they do the work assigned them because they are required to, and drop the study as soon as they are allowed to.

We cannot presuppose that the high-school pupil has any interest in technical botany, for the average boy or girl has no knowledge of the facts on which science is founded. Some of our pupils do have an interest, often a most superficial one it is true, in the flowering plants of their locality. They will often gather the more conspicuous blossoms and even know common names for some of them, and almost universally want to know the names of others. Here then, is a point at which we may make a beginning, and, even under adverse conditions, hope to accomplish something lasting. Hence I will say unhesitatingly, that we should teach our classes of beginners in the high schools, especially under existing conditions, the morphology of the flowering plants and how to find out the names of the plants, that is analysis. I would not have this the only work done, but I would advocate, and as much

more as is possible, but in ten weeks, or in twenty, which is often the limit of time devoted to the subject, we cannot do thoroughly much more than that. In doing this work, I would not if it could be avoided use books for the study of the organs, but have the class work wholly from specimens of the parts under consideration and teach from them, and I would not leave one set of organs until the various parts and relationships were understood. I would if possible have the members of the class understand from the beginning that plants are alive and that botany is the study of things that are living.

Botanically speaking this may be wrong, radically wrong, for it is beginning at the top of the ladder, to have beginners work on the most complicated vegetable organs and even have them work at finding the names of the highest plants, or, even, for the time being, make that the object of study. This latter plan is exceedingly abhorrent to the botanist, for he says, and perhaps truly, that classification is the least important, is of least interest, and has the least scientific value.

But to those of us who are teachers as well as botanists, there is another aspect of the case, especially if we are teachers before we are botanists, as should be the case if we are teachers at all. From the pedagogical side we see the matter in quite a different way, and that which seems radically wrong to the botanist, is both radically and theoretically right, for it has the broadest of foundations in the great underlying principle of all teaching, "from the known to the unknown." Most pupils know something of flowering plants and they are familiar with, and accustomed to the common types. They have an interest in them, or have had at sometime, and this may be aroused anew by a little judicious effort by the teacher. Thus we have two most potent allies, familiarity, and the pupils' interest.

To digress for an illustration drawn from personal experience: not long ago the writer was discussing before a class of beginners, fruits, and the food supply in them, and, asking for examples, some member of the class mentioned the potato. Having some potatoes at hand they were distributed and in a moment every one was alive with interest, while before only moderately good attention was shown to what was being said. The reason for the change was easily apparent, for the pupils thought they knew something about the potato and wanted to tell it, while they did not care to hear about the facts which were being told, for they had not reached the stage of knowledge where the facts had any significance. During the discussion which followed some very important botanical truths were developed, and the class came to the conclusion that the potato was not a fruit.

The first question that is asked by the average student, when he is shown a plant with which he is not familiar, is "What is it?" and until you tell him, he shows much interest. He is frequently interested in learning something about the habits of the plant after he has learned the name, but first he wants to know the name. It would seem that this very curiosity to know plant

names ought to be taken as an indication that it would be working along lines of least resistance to teach such pupils to find out the names of plant forms with which they are likely to come in contact, and later, when new questions arise, new lines of work suggested by them should be taken up. The method has certainly the least mental inertia to overcome in the pupil, and on that ground if no other, it should be abandoned only when pedagogical, not purely botanical reasons, are urged it. The collecting of plant specimens for making an herbarium is often an incentive to the study of plants in their native haunts which can and should be fostered to the great advantage of the student, and while, it is true, there is great chance for abuse in this, as in all other methods of class work, in any subject, many a botanist of today, has the good old-fashioned, herbarium of fifty or a hundred, poorly prepared, poorly determined specimens which he made when a boy, to thank for the faith that is in him, and even now remembers the pleasure he had in collecting it.

Pupils must be taught to see with their unaided eyes before they can profitably work with even the simple microscope, and this furnishes us with another reason why the study of the seed-bearing plants is likely to be more profitable to beginners in botany than that of any other group. The use of the compound microscope involves the loss of some valuable time from the very limited amount at the disposal of the beginner, and often it is much that is lost, for it takes the average pupil a considerable time even to learn to see with unaided eyes, and much longer to see intelligently with a compound microscope.

It would seem therefore, to be a mistake under conditions existing in our schools at present, to begin the study of botany by examining the protophytes first, and to follow that up by the study of other unfamiliar cellular and microscopic forms, for by the time the vascular and more highly organized plants are reached, the patience and interest of the pupils are exhausted, and while they have been introduced into a world that is new to them, it is one they did not care for and into which they will never penetrate again willingly.

It is also for reasons stated above, of very little use to spend much time in the study of the minute anatomy of the higher plants, or of vegetable physiology, for while the truths that are made plain by these departments of the subject are beautiful and full of meaning to more advanced students of botany, they mean nothing to the beginner, because he has nothing behind, with which to correlate such truths.

The writer does not advocate the entire omission of the study of minute structure and physiology from even the most elementary course in botany, but would urge rather that both be used to supplement the study of gross anatomy, as often as possible, but only as the need for such study is developed in the course of other work. When we have a course in botany beginning in the kindergarten, and ending in the university post-graduate courses, then we may, and undoubtedly will be able to have our students in the high schools

take up the study of the cellular plants with the highest profit, but until then experience is showing us that we should confine the work in elementary courses to flowering plants.

The question "how" can best be answered by experiment, for no two people can accomplish quite the same results in any given time or way. Botany should not be studied from books, but from plants, and one single plant, carefully studied may give work for a lifetime after the foundation for such work is laid. For beginners who start in midwinter, there is no better material for study than twigs bearing buds, in as great a variety as possible, and seeds, which may be studied by themselves or in connection with growing plantlets from seeds of the same sort. Leaves either dried or from exotic plants should be used to teach the many things that can be taught from leaves. This work, in connection with the study of roots and the winter forms of plants may be prolonged until spring. The pupils should be required to make careful drawings of all the forms which they study and to write full and accurate descriptions, which should be made comparative whenever practicable. During this period, and later as well, the necessity of using concise and exact language, of having exact knowledge before they write, should be enforced upon the pupils, and much valuable training may be had in this way, apart from purely scientific lines. When the season for the blooming of wild flowers comes, the members of the class should be instructed in collecting material for study, and if possible, the class should be taken into the field and taught there.

A word in regard to the text-book may not be out of place here. The chief defect of our text-books seems to be, that they are made for the botanists and not for our schools, that is, they are written by the best authorities, and are written, it may be unconsciously, with the thought of what the botanical world will say about them, rather than with the thought of what the needs of the schools are. The result is often books that are admirable as monuments of learning, but they are not for the schools. The text-book in botany should be used only as a guide, and if but a single page can be mastered by the class, that is all that should be used. It should be remembered also that facts should come before theories, and do in a normal course of development and students of botany should be allowed to acquire a certain number of facts before much of theory coördinating facts is given them. In closing, the writer would take occasion to urge upon teachers here assembled, the importance of making an effort to bring about such a change in the courses of study in our schools, that the study of plants and animals shall be made an organic part of the work in every grade from lowest to highest, and that these efforts be constant and unremitting until the end sought is accomplished. Then, and not till then, may the course which the botanist considers the ideal one be adopted successfully in the high school for the work in the lower grades will lead up to it by natural and easy steps.

Professor Spalding, of the University of Michigan, said in substance :

I do not care to discuss, as if we were engaged in preparing a school programme, the exact amount of work in this subject and the form that the daily exercises ought to take ; the schools can be trusted to work out such details for themselves ; what I do want to say, with all possible emphasis, is that botany, like any other science, will be well taught just as soon as trained teachers are appointed to teach it, and it will be poorly taught just as long as these are lacking.

It is so easy now to obtain instruction in the modern science of botany that there is no excuse for perpetuating the old order of things. One can get, in any one of fifty or a hundred universities, colleges, and normal schools, laboratory instruction that a comparatively few years ago could be had in hardly half a dozen institutions in the country.

Not only in the regular courses of our universities, but in easily accessible summer schools, facilities are offered, both in the morphological and physiological study of plant life, that many of the present generation of teachers were obliged to visit foreign laboratories to obtain. With all these opportunities brought to our very doors, there is no longer any valid reason why teachers of botany, any more than teachers of language or mathematics, should be unprepared for their work. As a matter of fact a new generation of science teachers is already on the ground, and their ranks are steadily filling with young men and women who are making the study of botany a very live thing. The trained teacher is coming, and the rest is sure to follow.

I find some practical difficulty in giving an explicit answer to the questions, "what?" "how much?" and "how?" but I should say secure if possible an entire year for botany in the preparatory school, but if only half a year is to be had make it a half a year of such discipline as the pupil can get in no other subject, a training of eye and hand and judgment, the develment of patience and all the laboratory virtues, and be sure to leave him at the end of the course, not with the self-approbation of one who has "collected fifty specimens" and has nothing else to do, but with eyes that have been opened, so that every living thing he meets asks him questions about its origin and relationship, and the meaning of its form, color, and structure. There is no royal road to all this, no text-book that is a sufficient guide; only the living teacher, who himself has found it, can show the way.

DIGEST OF DISCUSSION ON SUBJECT: "POLITICAL ECONOMY IN THE HIGH SCHOOL."—J. E. LAUTNER, PRINCIPAL CADILLAC HIGH SCHOOL

Any educational system is determined by the ideal of life that prevails among a people. The ideal of America is that of democracy, which aims at

the development of every individual. The food for this enlargement and enrichment of the individual is derived from various sources of human culture, as the Hebraic, the Helenic, the Roman, the Teutonic. The latter has given us (*a*) modern languages and literatures, (*b*) science, (*c*) a complex industrial system (due to use of steam). All of these elements of human cultivation are discharging their rich content into our secondary schools, except that of industry. Its culture and guidance value are as great as that of any of the other sources named, and hence ought to have a place in the high school. Moreover, all the serious problems which we are to solve are of an industrial character. The Renaissance freed men intellectually, the Reformation religiously, the French Revolution politically; it is the business of democracy to free men industrially, and to provide and to maintain equal opportunities for all individuals.

This ideal can largely be attained by the study in our high schools of no formal and metaphysical economics, but the subject-matter suggested by such terms as industrial history, the evolution of industry, the study of industry, etc. There are no adequate text-books on this subject for high school purposes. The new books should devote a large space to the history of inventions. The other leading phases of industry should all be presented in a historical and evolutionary way, rather than abstractly and analytically. Each phase should be so treated as to throw light upon current problems. The best results are obtained if the subject can be taught in the last year of the high school.

OUTLOOK NOTES

PUPIL STUDY

THE admirable articles of Dr. Atkinson and Dr. Burnham in the December SCHOOL REVIEW really open a new era of thought and discussion for secondary-school teachers. Since the world began, so far as concerns education, some teachers have been studying pupils. Great teachers have uniformly given more thought to their pupils than to school organization. Educational psychology has issued in pedagogic dogma and formal methods. The marvelous expansion of the field of education during this century has compelled the giving of a large measure of attention to questions of organization and management. For the past five years the question of curriculum has dominated all discussion of secondary education. The Principal as Programme Maker has been the hero of the hour. May not the next hero be the Principal as Pupil Student? Is it not time to shift the emphasis a little from the organized whole to the individual unit? Are we all not in danger of forgetting at times that the school exists wholly for the good of the individual student? The whole question is one of perspective. Let us bring into the foreground the individual boy or girl in that trying adolescent period so fraught with danger yet so glorious in possibilities.

PARTIALITY

WHAT objections may be urged against such pupil study, with the added attention to the individual that it necessarily implies? A few days ago a good principal told me he was afraid the public would raise the cry of partiality. This country is a democracy. All men are created free and equal. All are entitled to precisely the same treatment in the schools. There must be a uniform course of study through which all children must be driven. This principal believes this doctrine; he will have no pupil study in his school at present.

Doubtless this objection will be met in many places. The battle must be fought at this point against one of the worst fundamental evils of any democracy and against the most erroneous and perhaps most widespread misconception as to the true meaning of democracy. The self-evident truth that all men are born equal is no more true as to mind and character than it is as to body. In a democracy all are entitled to the fullest opportunity for the development of all the powers and capacities with which they are endowed. To limit all to the same opportunities is not liberty but the worst form of despotism.

Partiality which results from the personal likes and dislikes of the teacher belongs to the absolute despotisms of the Orient and has nothing whatever in common with that wise adjustment of tasks to the strength of the pupil which result from a careful and dispassionate study of the child's nature. Wise foreign critics have said that a republican form of government tends to produce a dead-level civilization. Our uniform courses undoubtedly tend the same way. But such uniform treatment is not justice, but on the contrary the darkest injustice to the child. The best gift is opportunity, and this gift it is the duty of the public school system to extend fully and freely to every child. The principle of differentiation has already been fully recognized in the establishing of separate schools for various classes of defectives and delinquents. It is simple justice that normal healthy children with varying capacities should not be mercilessly fitted to the same Procrustean bed. Those "born long" should have as good a chance as those "born short."

C. H. THURBER

BOOK REVIEWS

Macmillan's Elementary Latin-English Dictionary. By THE REV. G. H. NALL. New York: The Macmillan Company Price $1.

COLLEGE students unquestionably need a new English-Latin lexicon. Harpers' is the only one to cover all the authors read in even undergraduate courses, and Harpers' is now further behind the times than its predecessor, Andrews', was in 1879, when Lewis and Short made the present revision. Lewis' *School Dictionary* (1888) is an excellent piece of work so far as it goes, but of the authors commonly read in our colleges it takes no account of Plautus, Lucretius, Catullus, Pliny, and the larger works of Tacitus. Lewis' *Elementary Dictionary* (1890) extends its vocabulary to include Catullus and Tacitus, but, besides ignoring Plautus and Pliny, it omits proper nouns and adjectives, to the sore distress of the student of Horace and Ovid. It also restricts illustrative material to the narrowest limits. No one of these is sufficient for the needs of the undergraduate: together, even, they will not answer all his questions as to the forms, meanings, constructions, and pronunciation of the words he finds in college classics.

Such a student will find no additional help in Mr. Nall's dictionary. In vocabulary it is inferior to the briefest of the three named above, Lewis' *School Dictionary*, giving in addition, it is true, the words used by Catullus, but omitting those of Terence, Juvenal, Curtius, Tacitus, and parts (not named) of Cicero. It is intended, according to the preface, to take the place of the special vocabularies appended to the editions used in English schools, and to accomplish this relies upon its distinct and attractive typography, and especially upon its marvelously low price.

Mr. Nall's dictionary is unquestionably an improvement upon the special vocabularies in English schoolbooks, so far as these are known to me, but it will not stand comparison with the vocabularies of our better American editions. True, our American editions of Livy, Horace, and Catullus are not supplied with special vocabularies, but the

few students who read these authors in our secondary schools will practice economy by buying one of Lewis' dictionaries at from twice to five times the price of Mr. Nall's. In the dictionary of Mr. Nall they will find meager definitions, illustrative examples so few as to be of little or no service in their composition lessons, quantities marked for metrical purposes only (*e. g.*, *cōnicio*, *mons*, *quintus*, *regnum*), not for pronunciation, and they will not seldom miss words for which they look (*e. g.*, *fello*, *lotium*, *inrumator*, *peditum*, etc., in Catullus). A low price is not enough to make up for defects such as these.

H. W. JOHNSTON

THE INDIANA UNIVERSITY

Specimens of the Pre-Shakespearean Drama, with an Introduction, Notes, and a Glossary. By JOHN MATTHEWS MANLY, Professor in Brown University. The Athenæum Press Series. In two volumes. Ginn & Co.

EVERY teacher of English appreciates the advantages of giving to his students a first-hand knowledge of an author, or of a period in literature. Unless a large library is at hand, it is frequently difficult for an instructor to supply his classes with the literature that will provide this first-hand knowledge. The difficulty is especially apparent in the presentation of early Saxon, and, in fact, of all Pre-Shakespearean literature. These volumes by Professor Manly remove many of the difficulties in studying this early period. They contain the best productions, in part or in whole, beginning with fragments of the earliest liturgical plays, and extending through the miracle, mystery, and moral plays, and the interlude, to the final comedy and tragedy of the Elizabethan age. The specimens are carefully chosen, and are thoroughly adapted to a first-hand study of the development of the English drama.

F. D. NICHOLS

THE MORGAN PARK ACADEMY

NOTES

GINN & Co. announce *The Captivi and Trinummus of Plautus*, edited, with introduction and notes by Professor E. P. Morris, of Yale University, ready this winter; also *The Alcestis of Euripides*, edited with an introduction and critical exegetical notes, by Hermann W. Hayley, instructor in Latin in Wesleyan University, Middletown, Conn., ready in the spring.

THE Department of Superintendence of the National Educational Association meets at Chattanooga, February 22–24. A very interesting programme has been prepared, which, together with the attractive surroundings, should insure a large attendance at this meeting.

THE proceedings of the meeting of the Association of Colleges and Preparatory Schools of the Middle States and Maryland, held at Poughkeepsie, N. Y., during the Thanksgiving (1897) recess, will be published in full in an early number of the SCHOOL REVIEW.

GINN & Co. announce *A Guide to the Study of Fiction*, by Charity Dye, Teacher of English, High School, Indianapolis. This book is based upon the claim that fiction should have an equal place with poetry, the essay, oratory, and other discourse forms embodied in the curriculum of high schools.

MACMILLAN & COMPANY issue an admirable edition of *Horace* in one volume, containing the complete text of the author, and the substance of the introductions and notes contributed by Messrs. Page, Palmer, and Wilkins to the three-volume edition. Though the book contains 670 pages, it is not bulky, and the type is clear and beautiful.

TEACHERS of geography and physiography in Massachusetts will be grateful for the appearance of a monograph by Professor William Morris Davis, of Harvard, on the state map of Massachusetts as an aid to the study of geography in grammar and high schools. The monograph was prepared by the Massachusetts State Board of Education and was reprinted from the sixtieth annual report of that body.

THE College of Agriculture, Cornell University, is issuing a series of valuable teachers' leaflets for use in the public schools. These are planned to aid in nature study. No. 5, Some Tent Makers, and No. 7, Hints on Making Collections of Insects, by Anna Botsford Comstock, both contain much interesting matter with practical directions for elementary, entomological study. The two leaflets are handsomely illustrated.

THE *Faërie Queene*, by Edmund Spenser, is being edited by Kate M. Warren. The edition will be issued in six small volumes, each containing one book of the poem. Book I has appeared, and recommends itself for use as a text in secondary schools. The glossary is a very full one, and the notes are ample—too detailed, perhaps, for the more advanced student. The text is neat and well edited. (50c. The Macmillan Co.)

The Science Teacher, Vol. I, No. 1.—This periodical is to be published bi-monthly, or monthly if it seems advisable, and is to be devoted to the interest of science in secondary schools. The editor, Mr. A. T. Seymour, Dobbs Ferry, N. Y., invites the coöperation of all teachers of science in these schools, his object being to make his journal a medium through which new and helpful ideas may be made common property.

The first number, while showing haste in preparation, contains some interesting facts and suggestions. Subscription price is $1 per year. W. H. R.

Social Life in Old Virginia before the War, by Thomas Nelson Page ($1.50; Chas. Scribner's Sons), is an essay of great interest to students of American history. The author states that the chief aim of the book is to correct the ignorance of the outside world as to the real life of the South in the days before the Civil War. The slave question is touched upon, with the explanatory note that the picture of slavery drawn by Mrs. Stowe is not one which any Southerner would have stand as a final portrait of Southern life in slavery times. The author's style is always delightful, and the book is entertaining and instructive.

LITERARY *Art; A Handbook for its Study*, by Harriet Noble, A.M. ($1.00. Inland Publishing Co.) This work is highly recommended as a text-book for use in secondary schools, where too much attention is usually paid to the *theme* in literature and too little to the *art*, as this book presents it. "The purpose of the book is to recognize literary work as an art; to define the more essential properties of this art connectedly, and to exemplify their application in systematic analysis." To those schools which have not emphasized the importance of the artistic element in literature this work will prove of no little assistance.

HENRY HOLT & CO., will publish shortly *An Introduction to American Literature*, by Henry S. Pancoast. The book is written on the same plan as his stimulating *Introduction to English Literature*, which has been so well received. In the latter book he treated the principal authors at comparative length and made their personalities as vivid as possible, largely omitting lesser authors and works. He also showed the formative influence of history on literature. His new book is expected to retain these characteristics, and to clearly show the close relation of English and American literature. Carefully chosen lists of works to be read in connection with this book will be a helpful feature.

Selections from Plato: The Apology of Socrates; The Phaedo, edited by H. T. Nightingale (Ainsworth & Co., 30c.), is an attractive and inexpensive book for the high-school course in English. The edition is based on the translation of Taylor. The notes are few and clear. A good analysis of the argument precedes each selection. The editor's introduction calls proper attention to the great themes of life and death with which the text deals. This is the first Greek prose classic to be offered in shape for class use in the high schools. The advantages of introducing high-school pupils to these great masterpieces of human thought are obvious. Mr. Nightingale's book makes it possible to reap these advantages.

Physical Experiments, A Manual and Notebook, by A. P. Gage. Ginn & Company, publishers, 1897. This volume is quite different from the *Physical Laboratory Manual and Notebook* by the same author. The aim, as stated in the preface, is "to meet the needs of classes in which those pupils who do not expect to pursue their studies further than the high school greatly outnumber those who are fitting for college." It is interesting to note that to accomplish this purpose the author has cut down the number of experiments given in the earlier work, mentioned above, from over two hundred to about ninety, and has included in this list nearly all of the exercises required for admission to Harvard University.

Historic Houses and Spots in Cambridge, Massachusetts, and Near-by Towns, by J. W. Freese. Ginn & Company, publishers. In 144 pages is here presented the result of a dozen years' search for old houses and other monuments of local history in the author's neighborhood. Though the region covered is of small radius, yet its importance in colonial and revolutionary times gives to this book a value more than local. Forty-six reproductions of photographs set forth, with a clearness that no word-picturing can equal, gems of colonial architecture like the Lowell and the Craigie House, and scenes of patriotism like those commemorated by the statue of the Minutemen at Concord, and the Old Bowlder at Lexington. The Wayside Inn, the Washington Elm, Faneuil Hall, the Old South Church, the Old Manse, are some of the best known among the subjects of these views. The pictorial work is of high order and accompanying the illustrations are brief explanations. Descriptions are also given of many historic spots not shown by pictures, and many commemorative tablets are reproduced.

DURING the holidays the Commission on English Requirements met in Philadelphia to complete the work begun in New York city in May. Though the report of this committee is awaited with great anxiety by many teachers all over the country, the committee bound itself to secrecy, so that nothing can be given out for publication for an indefinite period. The reason for this, it seems, was that certain of the delegates felt that they were bound to

report to the association that sent them before any general public announcement of the findings of the committee could be made. If this idea were logically carried out, it would be impossible for the commission ever to accomplish anything. The various associations represented meet at different times of the year, their meetings practically covering the whole year. Before all the members could report to their respective associations, a year would pass by and part of the report become invalid. The delay is in every respect unfortunate. Star-chamber methods are out of place in our country at this time. Everything is to be gained and nothing lost by openness and frankness in all educational discussions. The only reasonable inferences from the committee's desire for secrecy are that they have done something of which they are ashamed, or have done nothing, of which they are ashamed.

CURRENT EDUCATIONAL LITERATURE

NUMBER AND ITS APPLICATION PSYCHOLOGICALLY CONSIDERED. By D. E. PHILLIPS. *The Pedagogical Seminary*, October 1897.

TEACHERS in general, and teachers of arithmetic in particular, have at least one trait in common with those whom the nature-study people call "our little neighbors." In the poultry close, when one fowl runs to a certain spot and pecks at the earth, forthwith the whole colony rushes to this new Klondike, and all begin to peck away vigorously. After a little even a hen's intelligence is acute enough to see that this spot is just as barren as is the rest of the enclosure, and so one by one the harem disperses, and assumes a peripatetic air until another fowl cry of "Eureka" is raised.

These cries and rushes, and false alarms do much good in the poultry yard. They give abundant exercise, and they make it certain that the field is well explored. Occasionally some philosophic fowl may take a perch and survey the whole field, and discover some spot which promises a genuine food supply. Then a real contribution to the stock of knowledge is made, but such cases are rare.

In arithmetic method the hue and cry has often been raised, and the mad rush has followed, and the excitement has been intense, until someone has asked, "Is this spot any less barren than the rest of the field?" and then one by one the assembled crowd vanishes away.

Such was the case when Grube was discovered, a man who had only two original ideas in his system, both bad. Such is the case every few years in Germany, where the soil is favorable to the sprouting of pedagogical schemes. One has but to run through the pages of some work like Unger's *Die Methodik der praktischen Arithmetik in historischer Entwickelung*, to appreciate how periodic is this discovery of the panacea. We have similar periods in America.

Mr. Phillips is one of the rare investigators who sees beyond his own hobby. His hobby is there, and it is a good one and a broad one, and one that is psychologically grounded. But he has made a genuine effort to survey the field so far as it relates experimental psychology to number teaching, and he submits a thesis upon this subject which is more worthy of attention than any which has appeared in some time.

The thesis begins with a review of those experiments in psychology which throw light upon the question, a review which seems like an oasis in the desert to those who have to struggle through the current literature of the subject. The first step which the author discovers in the development of the number concept is the formation of a "series-idea." Which of the senses plays the leading part in this step he does not assert, showing again his superiority over those who are positive that it is this sense or that, and only this or that. For example, Preyer maintains that the sense of hearing plays the important part, Nichols favors the sense of touch, Pestalozzi, the sense of sight, Tillich, the sense of sight with the ratio idea prominent, and so on.

The series idea is then set forth at length, together with the results of a number of interesting experiments upon children, and of the study of savages and mathematical prodigies. These results establish the fact that "the naming of the series generally goes in advance of its application to things, while the tendency of modern pedagogy has been to reverse this." The conclusion which the author draws from his experiments is that "counting is fundamental, and counting that is spontaneous, free from sensible observation and from the strain of reason." Here he goes a step farther than Tanck and Knilling in a movement which has very much to recommend it.

The author's treatment of the ratio idea is such as to make the article one which all primary teachers, especially such as are attracted to this rejuvenated vagary, should read.

The breadth of view which is apparent throughout the investigation may be judged from the following paragraph: "The diversity of human intellects, human needs, human environments, child's spontaneity, psychic activity, and especially mental phenomena in dealing with number, demand that neither the teaching nor the text should be dominated by a single idea." This advice is worth a great deal to those who feel that arithmetic cannot be taught well unless somebody's "method" is fitted like a strait-jacket upon the child's soul.

The closing historical survey is too fragmentary to be of value, and the bibliography, while suggestive, not only contains several references of little use to anyone, but omits a number of standard works which teachers should always have upon book shelves.

DAVID EUGENE SMITH

MICHIGAN STATE NORMAL COLLEGE,
Ypsilanti

NEW PUBLICATIONS

Genesis of Number Forms. By D. E. Phillips, Clark University. Reprinted from the American Journal of Psychology, Vol. VIII, No. 4. Pamphlet form.

Number and Its Application Psychologically considered. By D. E. Phillips, Clark University. Reprint from the Pedagogical Seminary. Magazine size. Pp. 61.

Historic Houses and Spots in Cambridge, Mass., and Near-by Towns. By J. W. Freese. Size 5½ x 7½ in.; pp. 144. Price 85 cents. Ginn & Co.

University of the State of New York. Regent's Bulletin No. 38, June 1897. Laws, Ordinances, and By-Laws pertaining to higher education in New York state. Includes both the university law and the educational articles from the Constitution and the various statutes governing professional education and licences to practice, and other allied matters. Paper cover, magazine size; pp. 108. Price 15 cents, at Regent's office, Albany.

The Natural System of Writing. By A. F. Newlands and R. K. Row. Copy Books Nos. 1 to 6. D. C. Heath & Co.

The Athenæum Press Series. Specimens of the Pre-Shakespearean Drama, with an Introduction, Notes, and a Glossary by John Matthews Manly, Professor in Brown University. Vol. II. Size 4¾ x 7½ in.; pp. 590. Price $1.40. Ginn & Co.

Library of Historical Novels and Romances. Edited by George Laurence Gomme. The Camp of Refuge. By Charles MacFarlane. Introduction and Notes by George Laurence Gomme. Size 5 x 7¾ in.; pp. 427. Price $1.50. Longmans, Green & Co., New York. Archibald Constable & Co., Westminster.

Library of Historical Novels and Romances. Edited by George Laurence Gomme. Harold, the Last of the Saxon Kings. By Lord Lytton. Notes and Introduction by George Laurence Gomme. Size 5 x 7¾ in.; pp. 415. Price $1.50. Longmans, Green & Co., New York. Archibald Constable & Co., Westminster.

University of the State of New York. Extension Bulletin No. 22, November 1897. Report of Extension Teaching Division, 1896. Paper cover, magazine size. Pp. 429. Price 10 cents. Albany.

Twenty-ninth Annual Report of the Albany High School, Year Ending August 31, 1897. Published by order of the Board of Public Instruction. Paper cover. Size 5¾ x 9¼ in.; pp. 80. Charles Van Benthuysen & Sons, Albany.

The Sun's Place in Nature. By Sir Norman Lockyer, K.C.B., F.R.S. Size 6 x 9¼ in.; pp. 360. Price $2.75. Macmillan & Co., Limited, London. The Macmillan Company, New York.

The Study of Children and their School Training. By Francis Warner, M.D. (London), F.R.C.P., F.R.C.S. (Eng.), etc. Size 5 x 7¾ in.; pp. 264. Price $1. The Macmillan Company.

Three Lectures on the Anatomy of Movement, A Treatise on the Action of Nerve Centers and Modes of Growth, delivered at the Royal College of Surgeons of England by Francis Warner, M.D., F.R.S.C., F.R.C.P., etc. Size 4¾ x 7½ in.; pp. 135. Price 75 cents. The Macmillan Company.

A Student's History of the United States, with Maps and Illustrations. By Edward Channing, Professor of History in Harvard University. Size 5¼ x 8 in.; pp. 603. Price $1.40. The Macmillan Company.

American Literature. By Katherine Lee Bates, Wellesley College, author of "The English Religious Drama." Size 4¾ x 7 in.; pp. 362. Price The Macmillan Company.

La Guerre de L'Independance en Amérique Jusqu' a 1783, par M. A. Moireau. Edited and annotated by Alphonse N. Van Daell, Professor of Modern Languages in the Massachusetts Institute of Technology. Size 4¾ x 7¼ in., pamphlet form; pp. 59. Price 25 cents. Ginn & Co.

The Social Mind and Education. By George Edgar Vincent, Assistant Professor of Sociology in the University of Chicago. Size 5¼ x 8¼ in.; pp. 155. Price $1.25. The Macmillan Company.

Johns Hopkins University Studies in Historical and Political Science, Herbert B. Adams, editor. Fifteenth Series, XII. Tendencies in American Economic Thought. By Sidney Sherwood, Ph.D. Price 25 cents. December 1897. Published monthly. The Johns Hopkins Press.

American History Studies. No. 5. December 1897. Steps in the Formation of the United States Constitution. Selections made from the Sources. By H. W. Caldwell. J. H. Miller, Lincoln, Neb.

European History Studies. No. 4. December 1897. Alexander's Method of Warfare. Selections made by Fred. Morrow Fling, Ph.D., University of Nebraska. J. H. Miller, Lincoln, Neb.

Report of the Public Schools of San Diego, Cal., with the Course ot Study, 1897. Also extracts from the Rules and Regulations. Pamphlet. Published by order of the Board of Education. The Tribune Company, printers, San Diego, Cal.

Four True Stories of Life and Adventure. By Jessie R. Smith. Size 5 x 7½ in.; pp. 125. Price 50 cents. William Beverley Harison, 3 and 5 West 18th street, New York.

The Ethical Library. The Teaching of Morality in the Family and the School. By Sophie Bryant, D.Sc., Head Mistress of the North London Collegiate School for Girls, author of "Educational Ends" and "Studies in Character," etc. Size 5 x 7¾ in.; pp. 146. Price $1.25. Swan Sonnenschein & Co., Limited, London. The Macmillan Co., New York.

The Young Folk's Library for School and Home. Edited by Larkin Dunton, LL.D., Head Master of Boston Normal School. Vol. XII. The World and Its People. Book VIII. Australia and the Islands of the Sea. By Eva M. C. Kellogg. Size 4¾ x 7½ in.; pp. 448. Silver, Burdette & Company.

The Story of a Red Deer. By the Hon. J. W. Fortescue. Size 6¼ x 8½ in.; pp. 144. Price $1.50. Macmillan & Co., Limited, London. The Macmillan Company, New York.

The Students' Series. Laelius De Amicitia. With Notes by Charles E. Bennett, Professor of Latin in Cornell University. Size 5 x 7 in.; pp. 123. Price 60 cents. Leach, Shewell & Sanborn.

Appletons' Home Reading Books. Edited by William T. Harris, A.M., LL.D., United States' Commissioner of Education. Division I, Natural History. Nature-Study Readers. By. J. W. Troeger. I. Harold's First Discoveries. By J. W. Troeger, A.M., B.S. Size 4¾ x 7¼ in.; pp. 93. Price 25 cents. D. Appleton & Co.

Outlines of Elementary Economics. By Herbert J. Davenport, author of "Outlines of Economic Theory." Size 4½ x 7 in.; pp. 280. The Macmillan Company.